Popular Astronomy

Vol. XLI, No. 9 NOVEMBER, 1933 Whole No. 409

The Great Siberian Meteor of 1908

By GAVIN J. BURNS

The meteor which fell in Siberia on the thirtieth of June, 1908, was far the largest which has appeared within historical times; yet our knowledge of the circumstances of the fall is still very scanty. It was not until 1921 that some definite information came to hand. In that year, and again in 1927, Professor Kulic visited Siberia and procured a good deal of information concerning the fall of the meteor and the destruction which it caused.

The spot where the meteor came to earth is approximately in latitude 61° N and longitude 101° E. An observer at Komsk, about 450 miles to the southwest, saw the meteor travelling apparently towards Irkutsk, 600 miles south from the place where it fell. This can only mean that, from the observer's point of view, it was moving from left to right. Its real direction was probably from NW to SE, approximately. It appeared to be half the size of the moon. Nothing is known of its apparent height nor is there any record of its velocity. If the true direction was from NW to SE, it must have been overtaking the earth, in which case the velocity relative to the earth might have been small.

Over an area which extended for 60 km from the spot where the meteor fell, trees had been blown down, and the direction in which they fell was always away from this spot. Within this area all vegetation was burnt up. Everything was completely detroyed by fire. Within the area there are a large number of funnel-shaped holes varying in diameter from 10 to 50 meters, and of an average depth of 4 meters. Presumably a meteorite lies buried beneath each of these holes.

The most remarkable circumstance attending the appearance of this meteor was the unusual brightness of the night sky on the date of the fall and on the two following nights. It was seen in Siberia, in the northern part of Europe, and in the British Isles. It extended from Copenhagen in the north to Vienna in the south. At Edinburgh Observatory it was noted as being very striking, "practically daylight." In the north of England men worked in the fields all night getting in the hay. The prolonged duration of twilight was noticed at Valencia in Ireland. The glow in the sky was steadier than auroral light, and seemed to be simply an unusual prolongation of ordinary twilight.

When the news of the fall of the Siberian meteorite reached Europe, it was recognized that the twilight glow on the evening of the same day was an effect of the fall. The explanation suggested was that the twilight glow had its origin in the smoke and dust arising from the place

where the meteor fell. This gigantic bon-fire produced a column of smoke which ascended to the upper regions of the atmosphere where it met a current of air which carried the finer particles all over Europe. The result was that twilight was prolonged and appeared of unusual intensity wherever the cloud of dust hung over the land. This explanation is plausible and seems to have been accepted without consideration being given to its inherent improbability.

The most obvious objection is the very great speed at which the dust must have travelled. The meteor fell shortly after midnight. The glow was seen in London 22 hours afterwards. The distance travelled was 3500 miles. This is equal to a velocity of 170 miles per hour. But the dust could not reach the hypothetical current of air till some time after the fall of the meteor, so that the actual speed must have been a good deal greater. I do not know of any recorded case of a current in the atmosphere reaching such a high velocity as 170 miles per hour. When Krakatoa was in eruption the speed of the currents which carried the volcanic dust round the world was from 70 to 80 miles. In the recent eruption in the Andes the speed was much less.

It is very remarkable that there is no record of any unusual glow being seen farther west than Ireland. Nothing was observed in the United States. In reply to an inquiry addressed to the Meteorological Service of Canada, I was informed that "a search of the original records of observers in Canada has failed to reveal the existence of any note regarding this phenomenon." It seemed likely, if this twilight glow had been carried westwards by an atmospheric current, that it would have been seen by ships crossing the Atlantic. I accordingly got from Lloyds' List the names of about a dozen ships which arrived in British ports just after the thirtieth of June or sailed just before that date. This list was inserted in the "Manchester Guardian" with a request that anyone who had been on board any of the ships mentioned, and who had noticed an unusual glow in the sky, should communicate with me. No response was received.

It is hardly credible that a current of air should carry particles of dust from Siberia to the British Isles, but no farther. When Krakatoa was in eruption the volcanic dust was carried right around the world. It seems much more likely that the luminosity was caused by the direct action of the meteor on the upper part of the atmosphere. This might have been brought about in two ways. (1) It might have had a similar origin to the trains which meteors sometimes leave behind them. These trains have been known to last 40 minutes before they disappear. They grow very much in size before they vanish. If this meteor entered the atmosphere about the longitude of Greenwich and travelled through the upper air until it fell in Siberia, it might have given rise to such a train. If the train lasted for 70 hours and grew in size at the rate trains generally grow, the effect would be to cause a luminosity in the sky of the required extent and duration. When we consider the exceptional size

of this meteor there appears to be nothing extraordinary in the effect produced. (2) The meteor might have been accompanied by a very large number of very small meteors. The latter would be scattered through the atmosphere and reduced to dust. This dust, as long as it remained suspended in the atmosphere, would have the effect of strengthening the twilight which at the end of June lasts throughout the night in latitudes over 50°. There is no direct evidence that a meteor is ever accompanied by such a number of satellites, but it is quite possible that a meteor of great size might collect a cloud of cosmical dust in the course of the millions of years it has been journeying round the sun.

It may be objected that, if the meteor entered the earth's atmosphere in the longitude of Greenwich shortly after midnight, the luminosity of the sky should have been visible in England in the early morning of the thirtieth of June. It was in fact not noticed until the evening. It is probable that the meteor crossed the Greenwich meridian at a higher latitude where twilight was too strong for the extra intensity to be noticeable. Twenty-two hours later diffusion would have caused the luminosity to spread all over Europe. It was generally noted that the glow was stronger in the north.

If either of these hypotheses be correct the meteor must have traversed about 3500 miles of the upper atmosphere before it came to the ground. This is a very unusual length of track, but such a length is not unknown. The American meteors of the thirteenth of February, 1913, were actually seen for a distance of 2300 miles, but the actual length must have been much greater, for neither the beginning nor the end was observed.

My thanks are due to Dr. Whipple, the Superintendent of the Kew Observatory, for allowing me to see his translations of Kulic's reports.

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An Evergreen Observatory

By J. HUGH PRUETT

Private observatories of many types and in various settings have been described in Popular Astronomy in recent years. These have been so interesting that I fear ours does not deserve much notice. Its only appeal will be that it is "different." Its foundation is a concrete garage: its walls are evergreen ivy and laurel; its telescope is of unusually modest aperture.

Three years ago we decided that it would be very convenient to have a small telescope at our own home. Several factors were involved in this decision, not the least of which was the presence in the neighborhood of a keen minded lad of eight whose desire for constellation study seemed insatiable. His eager "Is it a good night for stars?" came over the phone too often to be entirely without effect.

A 3-inch equatorial (Mogey) was purchased. Like my fellow Oregonian (*P.A.*, 1930, **38**, 5) I found that the tripod mounting almost caused "strained conjugal relations." However, it was not the frigid condition of my feet but the unruliness of those of the tripod while being carried through the house that threatened domestic serenity. I had some objections myself. As the instrument was usually taken down

"Is It a Good Night for Stars?"

the hill to a vacant lot in front of the house, I met with transportation difficulties, especially on the return trips. When the circles were to be used, much time had to be wasted in leveling and setting in the meridian. If some one accidentally kicked one of the tripod legs, all had to be reset. Besides, with high powers the instrument was too unsteady. Finally a permanent mounting was decreed.

The top of the garage seemed to be the most convenient site. The roof is concave from above, thus affording no hindrance to construction on top. It was seen that the profusion of English ivy beside the building could easily be trained around the sides of a higher structure. To break the effect of a too great height at the front of the garage, the observatory wall was set back about six feet. Two walls are flush with the sides of the garage; the fourth extends about five feet beyond in

order to give room around the telescope. The ivy practically hides the effect of this bulge out over the lawn. The flooring, slightly spaced to allow rainfall to drain to the roof below, is supported by the concrete walls of the garage.

The wooden "pier" upon which the telescope is mounted is a 6"x8". The lower end rests on the floor of the garage. It extends up along the concrete wall (to which it is securely attached) and out through the roof and floor above. The part above the floor is neatly tapered and is enameled black. The improvement of this pillar over the tripod is very great.

An Evergreen Observatory.

A heavy growth of English laurel back of the garage provides the rear wall. A wire fence, five to six feet high, surrounds the remaining three sides of the floor. Into this the ivy is so interwoven as to make compact walls of green. At one corner a pink tausendschoen rose has worked its way through the vines. The white flowers of the laurel add charm and fragrance during the blooming season.

The lighting system is operated by a small storage battery under the floor. Wires running up the pillar connect to a switch and rheostat near the top. A flash light globe at the end of a short cord furnishes ample light.

The telescope is securely sheltered by a small house on casters. This is quite weather tight when closed and locked. The outer covering is tin, painted green to harmonize with the surroundings. This house is easily rolled back to the rear of the enclosure when the instrument is to be used. Shelves in it provide space for eyepieces, tools, sun projector, paper, books, etc. The *American Ephemeris* and the *Brit. Astron. Assn.*

Handbook are indispensable occupants of this small building.

The circles were constructed by gluing five-inch Keuffel & Esser cardboard protractors onto thin veneer. Great care was taken in centering these. The completed circles were glued onto the instrument and given two coats of shellac. Then all was enameled with black with the exception of the parts carrying the graduations. The declination circle is graduated into half degrees; the right ascension into two-minute divisions. Pointers and small lenses mounted in front of these enable one to estimate quite accurately to tenths of degrees and to half minutes. This is quite sufficient to bring an object practically to the center of the field when low powers are used. It will be "somewhere" in the field without even correcting for refraction, excepting when very near the horizon.

If the object is near a naked eye star of known position, a watch will take care of the R.A. and do it very accurately. If the appearance and the approximate position of the object are known, a setting in declination alone will suffice. Rotation on the polar axis will swing it across the center of the field.

Our instrument is equipped with a diagonal prism and five negative eyepieces (21× to 210×). For general star and nebula work I find nothing more satisfactory than the 31×. The area covered is wide (1°) and well lighted. Distortion is absent. The field of view is alive with beauty and without any suggestion of the "dismalness" given by high powers.

It will be surprising to those who have used equatorials without circles to find how much more may be done with even cardboard protractors rudely attached. The declination circle alone will do a great deal. Add a watch to the equipment and (with a little waiting) almost any thing within the power of the instrument may be located. A tripod mounting, only roughly adjusted for meridian setting and latitude, will do the work if a nearby star is used for reference each time. "Spotting" may often be done without circles at all if the width of field of the eyepiece is known and the observer has some ingenuity.

Many who for several years have used larger instruments than the one described here have never located such interesting objects as the famous and beautiful double star 61-Cygni, the dumb-bell, ring, and horseshoe nebulae, the globular cluster in Hercules, various tiny open clusters of great beauty, Uranus, Neptune, and the larger asteroids. A low power will often show a movement of Neptune during twenty-four hours if faint stars are near it for comparison. The asteroids often seem to move half way across the field from one night to the next.

Much of great interest which does not require the use of circles is missed by owners of small telescopes. Many have never had the pleasure of observing the frequent eclipses of the moons of Jupiter simply because they do not know where to get information on the times of occurrence. Many have no guide to the interesting study of double stars al-

though there are multitudes of these objects accessible to very small instruments. Those who know the unending pleasure found in these observations are always glad to inform others where the needed data may be obtained.

Our open air observatory would not be suitable for some localities. Freezing weather sometimes occurs here during the winter yet it is not common. Excepting during storms, wind at night is very unusual at any time of the year. When clouds do not interfere, telescopic work in the open is often very comfortable even in midwinter.

This small telescope in its unusual setting affords a great deal of pleasure to its owners and to others. It even has some advantages over larger instruments. It certainly can be handled much more easily. Poor "seeing" does not prevent its use so often. The field of view is wide. What need has any one who is doing purely amateur observational work with more than the 300,000 stars visible through a 3-inch? It will take one several years even to study all the doubles among them.

Here on the hillside we are well beyond the lights and noises of the city below. The evergreen walls and the elevated position provide seclusion. The occasional "passer by" on the street directly beneath often never suspects the presence of others inside the dark mass of green. To the lone watcher of the skies late in the evening when the neighborhood is quiet, when there is not even the murmur of a driving clock or motor (an occasional accompaniment with larger instruments), when the field of the telescope gleams with tiny points of light set in the deep blue curtain of immensity which so steadily moves its figures beyond the limiting circle of view, then—with all things mundane entirely forgotten, there comes a sensation closely akin to hearing their music as "the silent stars go by."

EUGENE, OREGON.

The Ring Plains of the Moon

By SIDMAN P. POOLE

Until that year of discovery 1610, no concrete evidence had been brought forward that in any way weakened the traditional faith in the metaphysical conception of a "perfect" universe; a cosmos of circles, epicycles, and smooth silvered spheres.[1] Then it was that Galileo shattered forever such ideas by showing to all, who cared to look, the rough, pitted surface of our neighbor, the moon.[2] It was indeed a critical moment in the evolution of human thought when the great Italian's little telescope first disclosed those seas, rays, rills, and craters that are such conspicuous features of the lunar landscape.

At the present date more than 30,000 of the craters have been mapped.[3] They unquestionably resemble terrestrial volcanoes but are much more numerous and larger—many exceeding 100 miles in diame-

ter. That they were not all formed simultaneously seems evident from the overlapping of crater upon crater and from the presence of inner rings as well as central peaks. Their great size (Ptolemy, near the equator, is 115 miles across) and their relatively smooth floors suggest "ring plain" as being a more appropriate name for areas whose rims in many

Figure 1. Lunar Ring Plain, Type A.

Figure 2. Lunar Ring Plain, Type B.

Figure 3. Lunar Ring Plain, Type C.

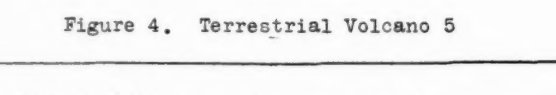

Figure 4. Terrestrial Volcano 5

cases would be invisible to an observer near the center. The term "crater" likewise suggests that they are of volcanic origin and this is by no means certain.

This was the first and most natural theory to account for their origin.

Professor Todd states that "volcanic origin is self-evident."[4] Strong objections have, however, been brought forward to this explanation. No great lava flows (A Yerkes Observatory photograph of Theophilus does show on its northern slopes certain features which bear a striking resemblance to the lava masses near Vesuvius, if the latter are viewed vertically and from a great height) or sufficient masses of ejected matter (Perhaps the eruptions were in the nature of the bursting of gas bubbles as has been suggested) are visible in the vicinity of any of the great ring plains. Furthermore, cross sections of the terrestrial volcano and the ring plain (Figures 1, 2, 3, and 4) present striking differences; differences that are hard to account for if we assume that both originated in the same manner.

Another theory (after a suggestion of G. K. Gilbert, the geologist)[6] is that these ring plains are the result of a colliding of the moon with a swarm of great meteors. (Perhaps the collapse of a ring such as that of Saturn?) The ring plain may be the scar of the direct impact of such bodies or else due to explosions produced by the heat resulting from these celestial collisions.[7] Why is not the earth similarly studded with such gigantic forms? Was our larger globe too plastic during the "bombardment"? Or has subsequent erosion removed all trace of such craters? Then there is a difficulty to the acceptance of this theory if the grouping of the craters is considered. The great majority of them are clustered in the light colored areas of the moon's surface while the dark seas appear like smooth plains and comparatively free from the elsewhere conspicuous circular cavities. And why are all the ring plains circular? Certainly a nearly spherical rotating globe, passing through a swarm of meteors, would not conceivably have hit every one of them "head on." The traces of glancing blows are lacking on the lunar surface.

Amongst other hypotheses to account for the ring plains, an ingenious one is described by Thomas.[8] It accepts George Darwin's theory[9] that the moon was originally a part of the earth and broke away from the parent body[10] because of enormous solar tides produced in the plastic mass. In its youth this satellite was rotating rapidly cooling and forming a partially rigid crust while its interior was still molten. Assuming these conditions, the magmatic matter would have been pulled in great waves towards the earth at each revolution. Here and there at weaker spots in the crust the lava would break through, flowing out in all directions over a circular area. After each high tide the liquid rock would ebb back through its vent leaving a frozen rim at its perimeter which successive flows would build up to their present form. Rings within rings might represent flows of a later period.

Certain comments on this theory suggest themselves to the geologist. The floor of many of the ring plains is well below the general surface level (Figure 2) and in others there is an absence (Figure 3) of the mountain ring.[11] It is hard to reconcile these phenomena with the

probable relief forms resulting from the assumed nature of the tidal flows.

Furthermore why were the vents all essentially circular openings? Why were none of the weak places in the crust, fissures? Would it not be more likely that longitudinal vents would form, paralleling the passing tidal stresses? If fissures had been the places for the escape of lava certainly circular ring plains would not have been formed. Why should not such vents be more abundant in the low latitudes where the earth's gravitative pull must have been greatest rather than crowding the southern hemisphere as they do? Finally, is it certain that *circular* plains would originate even under the assumed conditions? Might they not be oval; with a longer east-west axis; the lava flowing more rapidly to the west under the earth's attractions?

Besides merely raising these more or less academic questions it seems possible that the geologist could produce concrete evidence which might conceivably throw some light on the unsolved problems of the ring mountains. It is commonly assumed by astronomers that lunar relief forms are preserved for all time due to the complete absence of erosional agents.[12] Is this necessarily true? Are there no ways in which terrestrial experiment may be able to supplement and perhaps even guide lunar observation?

The albedo or reflecting power of the moon's surface averages about 0.07 which is equivalent to that of the darker colored terrestrial rocks, though it is true that the brighter parts of the crater walls reflect as much light as does volcanic ash. Lunar temperatures vary widely. Under the direct sunlight, 100° C is probably reached, while for a point opposite the sun Pettit and Nicholson estimate that the temperature drops to —160° C.[13] In the absence of an atmosphere the changes in temperature must be extremely rapid as each point on the moon's surface passes into its fourteen day night.

Can not certain of these conditions be reproduced experimentally in the laboratory? It would be extremely difficult, it is granted, to introduce the equivalent of "time effects" into such experiments but geologists have had tolerable success in studies of geophysical problems where at least reasonable allowances or assumptions can be made for this time factor. For example, why could not a selected series of igneous rocks that approximate the albedo requirements of the moon be exposed in the absence of air and for the proper length of time (the lunar day) to these measured temperatures? Such a series of experiments, with obvious variations and controls, might give some idea of the amount of disintegration that would take place on the moon's surface. The geologist might then be in a position to determine the possible relief forms that would be produced under the known physical conditions of the ring plains.

If such data as this rate of disintegration and the possible topographic forms to be expected under lunar conditions could be furnished to the

astronomer by the geologist, it would seem that the former might attack certain phases of the ring plain problem with a greater hope of solution. Since the modern telescope can detect objects no larger than are our larger buildings[14] and since mountain heights, slope angles and crater depths can be determined with surprising accuracy, is it too much to expect that the nature of many relatively minor relief forms could be interpreted in the light of such experimental evidence? And if the mountain slopes that reflect light in the same manner as does volcanic ash were shown to have the angle of rest of disintegrated or fragmental material, would this not be a step towards the solution of the nature and origin of the ring plains themselves?

The thoughts, criticisms, and procedure suggested above are, of course, purely tentative. They are put forth in the hope that they may show the essential unity of two of our fields of knowledge and to suggest possible lines of coöperative research. At least they may serve to stimulate interest in the physiognomy of our fascinating neighbor.

REFERENCES.

1. Henry Smith Williams, *The Great Astronomers*, p. 158.
2. George Forbes, *History of Astronomy*, p. 60.
3. Forest R. Moulton, *An Introduction to Astronomy*, p. 211, and T. Gwyn Elger, *Map of the Moon*.
4. David Todd, *A New Astronomy*, p. 250.
5. Garrett P. Serviss, *The Story of the Moon*, p. 85.
6. Forest R. Moulton, *op. cit.*, p. 213.
7. John Charles Duncan, *Astronomy*, p. 131.
8. Oswald Thomas, *Heaven and Earth*, pp. 66-67.
9. The impossibility of this theory is now admitted by Jeffries who for long was one of its chief supporters. See: Harlow Shapley, *On Facts and Fancies in Cosmogony*. Sixma Xi Quarterly, Vol. xxi (March, 1933), p. 1.
10. Russell, Dugan, and Stewart, *Astronomy*, Vol. 1, p. 467.
11. Russell, Dugan, and Stewart, *ibid.*, p. 177.
12. Russell, Dugan, and Stewart, *ibid.*, p. 178; and Forest R. Moulton, *op. cit.*, p. 214; and John Charles Duncan, *op. cit.*, p. 131.
13. Edward A. Fath, *The Elements of Astronomy*, pp. 78-79.
14. David Todd, *op. cit.*, p. 246.

Fireballs of 1931 February 4

By WILLARD J. FISHER

On the morning of 1931 February 5, a telephone call, informing the Harvard Observatory of the passage of a brilliant meteor the preceding evening, was immediately corroborated by two members of the Observatory staff. The assistance of the Boston papers and of the Associated Press was immediately sought, and on February 26, by their help, about fifty reports had been received. Plotting on a Geological Survey map (scale 1:1,000,000), with computing, showed that the best observations could not be reconciled by the hypothesis of a single meteor, and that the grouping of the observers' locations indicated cloudy areas over northern New Hampshire, Vermont, and central and western Massa-

chusetts, with much of Connecticut. From these regions, in spite of an hour favorable for numerous observations, few reports were received.

The reports fall naturally into two groups, indicating the flight of two meteors.

(1) Dorchester, Mass., Chas. Pollan; about 7:10; the meteor was exactly overhead; true bearings, initial 100°, final, 275°.

Newtonville, Mass., Percy S. Stiles; on Walnut Hill; just about 7:15; . . . passed slightly south of the zenith . . . crossed the meridian some 15° to 20° south of the zenith . . . travelled due west with practically no appearance of curving . . . crossing as much as 120° of the sky.

Arlington, Mass., Mrs. Florence T. Bell; meteor came from the east and was moving in a westerly direction . . . possibly one-eighth of the quadrant down from the zenith.

Weston College, Weston, Mass., a member of the faculty, by Rev. M. J. Ahern, S. J.; it seemed to come directly downward—vertically downward—to the western horizon.

These four indicate the passage of a meteor through the zenith of a place somewhat, but not much, south of Boston. This is corroborated by Robert S. Keough, Newtonville, though not in precise terms.

Goffstown, N. H., E. H. Jones: 7:17 by watch, error of watch unknown; first noticed about 10° above Sirius, moving southwest through Lepus, just under β Orionis, past γ Eridani, disappearing south of σ Ceti.

Combining these astronomical data, given by an expert observer of the American Association of Variable Star Observers, with a vertical plane of motion between Dorchester, Newtonville, and Weston, and assuming as sub-initial point the intersection with this on the earth's surface, of a vertical plane through Goffstown and Sirius, the following result:

Sub-initial point in Boston Bay, between Deer Island and Long Island:

Distance 0 km, height about 59 km, Goffstown-Sirius.
Distance 33 km, height less than 61 km, Goffstown-Rigel.
Distance 64 km, height less than 49 km, Goffstown-γ Eridani.
Distance 98 km, height less than 42 km, Goffstown-σ Ceti.

The meteor is described thus:

Dorchester; I thought it was fireworks . . . about twice the size of Venus.

Newtonville; a ball of blue green was followed by a short tail of dull red . . had very much the appearance of a shot from a Roman candle not more than 100 feet in the air . . . no sound.

Arlington; color emerald green, tail orange.

Goffstown; color blue tinged with crimson; size appeared to me as large as a baseball.

The estimates of duration are, as usual, various: 2 or 3 seconds, not more than ½, about 4, 4, about 5. As none of these was obtained by counting, there is little to choose among them. The projected path of the meteor was no doubt longer than the 98 km given in the table, for the initial altitude at Dorchester was reported as 40°. This would prolong the path backward out to sea roughly about 90 km eastward, and would make the true initial point as seen from Dorchester about 75 km high. The estimates of E. H. Jones are 5 seconds for the segment of the projected path Sirius-σ Ceti, 98 km; whence the velocity along the

path would be more than 20 km/sec.

(2) Wianno, Mass., David L. Garrison; 7:30 P.M. ± 15, very uncertain: first aware of it almost directly overhead, perhaps slightly northeast of the zenith; ending seen through trees; saw no other meteor during 20 min. previous.

Fall River, Mass., R. Gardner Reed; 7:00 to 7:15; started a little west of the zenith, went westward until it was about two-thirds down to the horizon.

Franklin, Ct., on farm, Thos. F. Murphy; 5 to 10 minutes after 7:00; right overhead, going westward.

Bozrah, Ct., Michael Yankiewitz; 7:15 ± 5; saw it passing almost overhead . . . had to bend head back; [by a small sketch] going east to west.

Bozrah, Ct., Mrs. E. A. Parker; 7:15-7:30; directly overhead; ending a little way above the hill.

Cambridge, Mass., L. V. Robinson, of Harvard Observatory staff; 7:14 ± ¼, by watch noted within a half minute afterward.

Cambridge, Mass., Miss Annie J. Cannon, of the Harvard Observatory staff; a little before 7:15, by watch noted immediately.

Beverly, Mass., on Prospect Hill, Miss Mildred E. White; a little after 7:00; it seemed to have come from Jupiter and passed just below Rigel, and then disappeared into the dark clouds of the west.

Quincy, Mass., A. W. Weeden; about 7:10; course apparently east to west. It crossed about 2° or 3° south of Betelgeuse . . . passed from view behind some low lying clouds above the Blue Hills.

Greenfield, Mass., C. Bernard; about 7:13; by sketch of constellations, two points derived, identified by Upton's star atlas as $6^h\,30^m$-19° and $5^h\,35^m$-15°.5.

South Boston, Mass., N. Y., N. H. & H. R. R. inspection pit, at Dover St., J. J. Mahoney; about 7:00; beginning over Dorchester Heights, ending over Boston City Hospital, all points marked on a map of Boston; these give as mean values of true bearings, initial, S 48°.6 E, final, S 78°.3 W, with considerable spread on account of the areas of the landmarks used.

Vineyard Haven, Mass., Mrs. W. W. Claghorn; a little after 7:00; meteor observed from a point well along in its flight, to end; final bearing, W ¼ N.

Whitinsville, Mass., E. P. Guptill; about 7:30; not exact, but it is assumed that the meteor of 7:14.5 is referred to. The meteor passed over to the south . . unobstructed view of it for about 90° of its path. From sketch, an estimated altitude is 30°. While not precise, the observation is useful here, because the place is well to the westward, and is between the paths of the two supposed meteors.

Observations of a meteor passing the southern sky at low altitudes corroborate the above: Cambridge, Mass., J. Cassels, W. W. Williams; Boston, Mass., A. D. Keough, Miss M. Dieter; Reservoir Station, Brookline, Mass., Miss M. E. McKenna; East Boston, Mass., M. L. Keyes; Medfield, Mass., Mrs. E. H. Sawyer; Stoneham, Mass., H. E. Brown.

Numerous other observations, made mostly to the north of both meteor paths, could be assigned to one or the other equally well. The most distant points of observation were Brooklyn, N. Y., J. A. Dittrich, and New York City, Palisade Ave., Miss C. Dominguez. At each of these a meteor was seen in the north, probably one or the other of the two above.

In computing the observations, the points Wianno, Fall River, Franklin, and Bozrah give the projected path and the vertical plane of motion, somewhat north of Wianno and between Franklin and Bozrah, bearing about 3° south of west. The astronomical data give points on this plane as follows:

Assumed sub-initial point, intersection on the ground of the plane

of motion and the mean initial direction from South Boston, Dover St., which point lies halfway between Dennisport and Harwichport, on Cape Cod.

Distance 0 km, height — km.
Distance 33 km, height less than 89 km, Quincy-Betelgeuse.
Distance 43 km, height less than 82 km, Beverly-Rigel.
Distance 139 km, height about 80 km, Greenfield, first point.
Distance 167.5 km, height about 68 km, Greenfield, second point.

The bearing of the ending point from Vineyard Haven indicates that it was beyond the Hudson River; but the intersection with the Wianno-Franklin line is very acute, and the position is too uncertain for confidence. The various observations of final angular altitude do not help much here. The estimates of duration of flight are again so varied that no velocity can be computed. They range from less than a second to 30 seconds. No one counted seconds.

The meteor is described as follows:

Wianno; brilliant flash startled . . . like a yellow ball of flame, trailing a long, whiter, frazzle-edged tail. The ball looked (off hand) as big as a toy balloon fifty yards away . . .

Fall River; a large ball about the size of a saucer . . . pink as it started . . . left trails of reddish purple in its wake.

Franklin; it began to get brighter, and I looked straight up and saw this ball of fire with a tail . . . and sparks flying from the tail . . .

Bozrah, Mrs. E. A. P.; the most brilliant light I ever saw . . .

Bozrah, M. Y.; the whole sky seemed lit up . . . looking somewhat like a falling star only for a tail full of sparks right behind it.

Cambridge, L. V. R.; head whitish, tail green, length 10° or more.

Beverly; . . . looked round in shape. It had quite a long tail. It was a very bright yellow.

Quincy; . . . apparently one-sixth to one-eighth the apparent diameter of the moon . . . its brightness apparently changed a number of times.

Greenfield; . . . purple color on its downward journey, giving off particles that seemed to burst in flame, making a trailer of fire . . .

South Boston; something like an aerial bomb . . . always throwing off tails of fire. The center of the course was pure white flanked by yellow, and on the extremes by bright blue . . . A revolving motion could be seen clearly. No explosion heard.

Vineyard Haven; all colors of blue; . . . train; . . . noise, none; looked like a flower-pot rocket after it had burst . . .

Whitinsville; no sound.

Cambridge, W. W. W.; blue, just a flash . . . as brilliant as a Roman candle ball.

Cambridge, J. Cassels; like a sky rocket . . . while still above the horizon it faded out. The light was warm yellow . . . a short tail of flame . . .

Boston, A. D. K.; an increasing glow in the sky, growing rapidly in brilliance . . . an "electric blue," flooding the whole window area without apparent gradation . . . the front (of the meteor) had a distinct spherical curve . . . The whole illumination seemed to fade without variation.

Boston, Miss M. D.; like a large ball of white light.

East Boston; it did not burst . . . a scintillating ball of brilliant blue fire . . . It had a train of brilliant orange sparks . . . about ten times as long as the meteor's apparent diameter. I heard no noise.

Medfield; . . . a most gorgeous ball of fire with a long tapering train, red, yellow, and blue-tipped . . .

Stoneham; It looked like a yellow ball of fire with a square-tailed train about five times as long as the ball of fire. . . . did not hear any noise, and it did not burst while in my sight.

It was at first assumed that the astronomical data from Goffstown referred to this meteor. But, on computation, they gave heights entirely irreconcilable with the equally good observations at Beverly, Quincy, and Greenfield; consequently it was necessary to assume two meteors, so nearly simultaneous that the rough observations of time could not separate them.

This case of February 4 is interesting, for there seem to have been two nearly simultaneous meteors pursuing nearly parallel paths, both going nearly west, but not both seen by any observer. As the inclination of the path is in each case badly determined, and no certain velocity can be determined, no attempt has been made to compute a radiant or an orbit.

It is probable that the newspaper dragnet method of collecting observations brings out such cases of multiple meteors when otherwise they would escape notice.

Race Distribution

By G. H. HAMILTON

I agree with Stansbury Hagar when he states in "The Portsmouth Works" (POPULAR ASTRONOMY, January, 1933)—"The existence of serpentine temples in the Old World as well as the New does not necessarily imply intercommunication between their builders. However, there are analogies between the constellations of the Old and New World, especially those of the zodiac, which are difficult to explain as of independent origin, so we may rightly hesitate to dogmatize on this subject until our knowledge of it is more complete."

Transfusion of cults, culture, and commerce over the face of our globe has heretofore been based on the land areas *being the same during the time that man has existed on the earth.* Has this been the case?

Past movement of continental masses has been suspected for many years, and according to Wegener the motion still continues. As I pointed out in "Continent Formation and Legend of Atlantis," (*Pan-American Geologist,* for August, 1928), no explanation, to my knowledge, had as yet been forthcoming for the lack of the lighter continental crust over the greater portion of the globe, this lack being now filled by our seas, until it was brought out by Professor Pickering in "The Separation of the Continents by Fission" (*Geological Magazine,* June, 1924).

According to Darwin the moon left the earth while both as one whole were in a molten state, the moon being cast off from the equator when the period of the earth's rotation was about three and one-half hours. The tidal action of the sun together with the free period of oscillation of the earth had set up a forced harmonic motion which resulted in the last huge tide or tides being forceably drawn away from the earth to

ultimately form the moon. If this were so, the earth, as it was then left, must still have been molten and no reason has as yet been given to explain why the crust of the earth should not have been formed homogeneously over the whole surface precluding any possibility of a lack of crust as we find at the present time.

If then we are to discard the Darwin theory of the origin of the moon, there remains that of Professor Pickering where the moon was forceably lifted off the surface of the earth from the area which is now the Pacific—increased by that of the Atlantic and other oceanic areas—by the close approach of some transient heavenly body. The density of the moon together with its mass points to the fact that the earth lacks in surface crust by just the amount which the moon now contains.

Provided then that the moon left the earth after the earth's crust was formed, let us see what our globe's surface conditions and climate would be like preceding the separation. I must again bring in Sir George Darwin and his tides, for his theory that the earth's period of revolution was very short in the beginning must be held to, since the tidal action of the sun has always had a retarding effect. So the farther we go back in time, the faster must the earth have rotated.

At a period before the earth's crust was formed the molten globe must have appeared as an accentuated spheroid of revolution, perhaps even more than is now seen on Jupiter. As the earth cooled, the rotation at the same time gradually slowing up, the crust formed beneath the heavy atmosphere. This was a period of turmoil such as may well be seen in ice jams at the present day. Later, as the crust became greater and greater, it became gradually more and more stable until it became an oblate spheroid flattened at the poles. At about this time, we will say, water began to precipitate out of the atmosphere and eventually covered the whole surface of the earth taking on the same form as the crust beneath in conformity with the then period of rotation.

As the earth cooled beyond this point the crust buckled to a certain extent, not only to adjust itself to the probably shrinking interior, but from the fact that the interior was also attemping to take on a spherical shape as the period of rotation increased. This adjustment is still going on today as manifested in earthquakes. Bound by the outer crust the earth has never as yet found its equilibrium, but the waters that at one time covered the whole earth were not thus trammelled, the surface of the water becoming nearer the sphere than the crust of the earth, and the difference between the two ever increasing. In this manner as the globe slowed down in its rotation the waters gradually settled at the flattened poles and finally left the equatorial zone high and dry. It is at the equator then that we must first look for life on land and the first races of man.

The gradual increase in the equatorial land belt must have extended over a very long period, so long in fact that even civilizations sprang up and died away; but before the moon left the earth and dropped the

polar seas into the Pacific basin the main topographic features as we know them today must have been formed. This is curiously corroborated by something which was pointed out to me by my father, viz., that when the Americas abutted onto Europe and Africa there was no outlet for the three great American rivers, the Amazon, the Orinoco, and the Mississippi. The result of this can be seen in the present Sahara. These rivers must have entered the desert somewhere in the vicinity of Liberia. The West Indian Islands took their place between the north coast of South America and the southeast coast of Africa below Cape Verde. The old course of the Mississippi is now most probably defined by the north coast of Cuba, and the strait between Cuba and Haiti is very probably the outlet of the Orinoco which at that time was seemingly a tributary of the Mississippi just as it entered the landlocked sea.

This large inland sea would have been ideal for the growth of civilization around its borders. I understand that aero-photographers have discovered many signs of this below the waters of the Mediterranean, and surveys for flooding portions of the Sahara have also disclosed many ruins, but this is not enough. Before any attempt is made to render the Sahara fertile, all that is possible should be done to find the old civilizations around the present desert. The fact that the present bed of the Mediterranean is below the Sahara and shows traces of civilization furthers the idea that the Sahara was at one time covered with water, for when the ocean beds were filled at the time of the separation of the moon from the earth, the load of water taken from the Sahara would have lifted it and probably at the same time lowered that portion of the crust which now forms the Mediterranean.

It has been said that the Nordic races had their origin in the north and that pigmentation was an afterthought at least in the case of the Aryans who came south into India. May it not have been the other way about, that the equatorial races were bleached by the cold of northern climes? There is, of course, another solution. Evolution seems to have discarded hair as the lower animals were left behind. I need only mention that the white race or Nordic is the hairiest of all, the black the least! But against this the black has the thickest bony structure in the skull—the Chinese the thinnest. Which way does evolution work? Are the Nordics a later race, have they sprung from the status of the animal at a later date than the rest of mankind, and is their civilization just beginning?

If the Sahara was the seat of the civilization that has been left on the earth since the breaking away of the moon, the serpent worship in the Portsmouth Works and those in England and Brittany could easily have been radiated from there or conveyed.

THE HAMILTON OBSERVATORY, MANDEVILLE, JAMAICA, B.W.I.,
JANUARY 24, 1933.

An Aid to the Study of Optical Phenomena

By DR. A. J. GINSBERG

Light and the study of optics, while a subject of major interest to the philosopher and physicist for hundreds of years, remains a mystery to the average man. Thus when such a term as "optical bench" is mentioned, laymen greet it with expressions of polite curiosity, or simply raise their eyebrows. Indeed, it is surprising how many well-educated persons are almost completely ignorant regarding a branch of science that concerns almost every phase of modern life.

Investigation has shown that this lack of interest is due primarily to the inadequate attention given courses in optics by the average high school and college. Undoubtedly instructors have been handicapped by the high cost of good optical equipment, and being unable to give interesting and attention-holding demonstrations, have been obliged to rely on the theoretical exposition of literature and the lecture room. Only well-endowed institutions with ample funds for laboratory equipment can afford to provide adequate optical apparatus of the types heretofore available for individual instruction and experimentation.

Heretofore, such an important adjunct to the physics laboratory as the optical bench has been too costly when accurate enough for research work; or, if cheap enough for individual experimentation, has been too inaccurate and limited in application to be used for research work.

There have recently appeared advance notices of a new optical bench which represents a revolutionary improvement in design and manufacture, permitting it with its accessories to be offered at prices easily within the reach of the average industrial laboratory, high school, or college. With it almost every conceivable experiment in optics can be performed, either by individuals or as a classroom demonstration. Accessories are provided for experiments in reflection, refraction, diffraction, polarization, telescopy, microscopy, photography, spectroscopy, etc.

The usefulness of the bench can be further extended into the fields of photo-electric and thermo-dynamic phenomena by the addition of suitable equipment. Such devices are already designed and under construction and more items will be added to the already extensive list as the demand increases.

It is pointed out by the manufacturer that a laboratory or individual interested in optical research may make a modest beginning by purchasing the fundamental equipment required for elementary experiments. the more elaborate accessories may be added from time to time with assurance that each unit will be found perfectly adapted to the whole set.

Planet Notes for December, 1933

By CLIFFORD E. SMITH

The *Sun* will be moving from the western part of Ophiuchus to the central part of Sagittarius. The occurrence of the winter solstice on December 22 at $0^h\ 58^m$, C.S.T., will mark the beginning of winter in the northern hemisphere, and on that date the apparent motion of the sun will change from southeast to northeast. The distance from the earth to the sun will be decreasing slowly since the earth will be near aphelion; its distance from the sun at the beginning of the period will be about 91.6 million miles. The position of the sun on the first and last days of the month will be respectively: R.A. $16^h\ 26^m$, Decl. $-21°\ 43'$; R.A. $18^h\ 39^m$, Decl. $-23°\ 9'$.

The phenomena of the *Moon* will occur as follows:

Full Moon	Dec.	1 at	8 P.M.	C.S.T.
Last Quarter		9 "	12 P.M.	"
New Moon		16 "	9 P.M.	"
First Quarter		23 "	2 P.M.	"
Full Moon		31 "	3 P.M.	"
Apogee		4 "	7 A.M.	"
Apogee		31 "	9 A.M.	"
Perigee		17 "	6 A.M.	"

Mercury will be moving from the central part of Libra, across Scorpio, to Sagittarius. Its distance from the earth will increase from about 80 to about 130 million miles, and its apparent diameter will decrease from about $7\frac{1}{2}$ to about 5 seconds of arc. It will be at greatest elongation west on December 6 at 5:00 A.M., C.S.T. ($20°\ 41'$), and, on that date, it will rise about an hour and twenty minutes before the sun. Its position on this date will be R.A. $15^h\ 24^m$, Decl. $-16°\ 12'$. Conjunction with the moon will occur on December 15 at 4:00 P.M., C.S.T. (Mercury $6°.3$ N).

Venus will be in Capricornus, and it will set about three hours after the sun. Its distance from the earth will decrease from about 60 to about 40 million miles, and its apparent diameter will increase from about 27 to about 41 seconds of arc. An occultation[1] of Venus will occur when it is in conjunction with the moon on December 20 at 1:00 A.M., C.S.T. (Venus $43'$ S). On December 21 at 4:00 A.M., C.S.T., it will be in conjunction with Saturn (Venus $20'$ S). On December 31 at 5:00 A.M., C.S.T., Venus will reach its maximum brilliancy (mag. -4.4).

Mars will be in Sagittarius, and it will set about two hours after the sun. Its distance from the earth during this period will be about 200 million miles, and its apparent diameter will be about 4 seconds of arc. Conjunction with the moon will occur on December 18 at 5:00 P.M., C.S.T. (Mars $1°.3$ N).

Jupiter will be in Virgo just a few degrees from Spica. Its distance from the earth will be about 540 million miles, its apparent diameter will be about 31 seconds of arc, and it will rise an hour or so after midnight. Conjunction with the moon will occur on December 12 at 1:00 P.M., C.S.T. (Jupiter $6°.0$ N).

Saturn will continue in central Capricornus. Its distance from the earth will be about 980 million miles, and its apparent diameter will be about 14 seconds of arc. During the latter part of the month it will be on the meridian about three hours after the sun. On December 21 at 4:00 A.M., C.S.T., it will be in conjunction with Venus (Venus $20'$ S). Conjunction with the moon will occur on Decem-

ber 20 at 2:00 A.M., C.S.T., and at that time it will be occulted[2] by the moon (Saturn 19′ S).

Uranus will be in Pisces, and it will set soon after midnight. Its distance from the earth will be about 1800 million miles, and its apparent diameter will be 3½ seconds of arc. It will be in conjunction with the moon on December 25 at 11:00 A.M., C.S.T., (Uranus 5°6 S). Its position on December 15 will be R.A. 1ʰ 28ᵐ, Decl. +8° 37′.

Neptune will be in the southern part of Leo. Its distance from the earth will be about 2800 million miles, and its apparent diameter will be about 2½ seconds of arc. During the first part of the month it will rise about midnight. Conjunction with the moon will occur on December 9 at 4:00 P.M., C.S.T. (Neptune 3°0 N). Quadrature west of the sun will occur on December 4 at 5:00 P.M., C.S.T. Its position on December 15 will be R.A. 10ʰ 56ᵐ, Decl. +7° 44′.

[1] See Pop. Astron., p. 33, Jan., 1933. [2] See Pop. Astron, p. 36, Jan., 1933.

OCCULTATION PREDICTIONS

(Contributed by the office of the *American Ephemeris.*)

The quantities in the columns *a* and *b* are given for the purpose of making these predictions useful for any place within 200 miles of the point indicated. The procedure is as follows: Subtract the longitude of the point given from the longitude of the place in question; multiply the result, taking the signs into account, by the quantity under *a* for the star to be observed; similarly, with the latitude, using *b*; apply the sum of the products, with its proper sign, to the Greenwich C.T., and obtain the predicted Greenwich Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to subtract five hours; Central Standard Time, six hours, etc.

OCCULTATIONS VISIBLE IN LONGITUDE +72° 30′, LATITUDE +42° 30′.

Date 1933		Star	Mag.	IMMERSION Greenwich C.T. h m	IMMERSION a m	IMMERSION b m	IMMERSION Angle E from N °	EMERSION Greenwich C.T. h m	EMERSION a m	EMERSION b m	EMERSION Angle E from N °
Dec.	1	q Tau	4.3	3 53.2	..	..	130	4 42.8	..	..	196
	1	18 Tau	5.6	4 0.2	—1.6	+2.6	37	5 11.5	—2.2	—1.8	289
	1	21 Tau	5.8	4 17.9	—2.5	—2.0	118	5 23.6	—1.8	+2.6	211
	1	22 Tau	6.5	4 29.5	..	..	131	5 20.8	..	..	199
	5	52 Gem	6.1	1 21.5	—0.3	+1.0	107	2 25.0	—0.4	+1.7	258
	6	49 B.Cnc	6.0	11 23.1	—0.9	—1.7	110	12 31.4	—0.2	—2.1	307
	9	48 Leo	5.2	7 57.1	—0.7	—2.3	166	8 59.6	—2.4	+1.0	265
	10	75 Leo	5.4	5 44.4	—0.5	+2.5	75	6 28.6	—0.3	—1.8	347
	10	76 Leo	6.0	6 44.0	—0.8	+1.0	103	7 49.4	—0.8	—0.8	325
	20	42 Cap	5.1	23 45.5	—0.3	+0.6	31	0 41.5	—0.7	—1.1	262
	26	26 Ari	6.2	21 59.4	..	..	339	22 13.1	..	..	319

OCCULTATIONS VISIBLE IN LONGITUDE +91° 0′, LATITUDE +40° 0′.

Dec.	1	q Tau	4.3	3 3.9	—2.4	+0.3	105	4 11.1	—1.0	+3.2	209
	1	21 Tau	5.8	3 31.7	—2.4	+0.3	101	4 46.1	—1.4	+2.7	216
	1	18 Tau	5.6	3 32.5	—0.4	+4.1	17	4 27.8	—3.0	—1.4	297
	1	22 Tau	6.5	3 39.8	—2.7	—0.5	112	4 44.6	—1.2	+3.5	205
	5	52 Gem	6.1	1 19.9	+0.4	+1.1	92	2 17.7	0.0	+1.1	273
	6	49 B.Cnc	6.0	11 11.8	—0.8	—2.6	146	12 22.5	—1.5	—1.5	275
	10	76 Leo	6.0	6 33.6	—0.2	+0.4	117	7 36.9	—0.5	+0.2	302
	20	42 Cap	5.1	23 39.3	+0.2	+2.2	2	0 21.7	—2.3	—2.1	286
	28	7 Tau	5.9	5 55.1	—1.8	+1.7	36	6 52.0	—0.8	—3.3	304

OCCULTATIONS VISIBLE IN LONGITUDE +120° 0′, LATITUDE +36° 0′.

Dec.	1	16 Tau	5.4	2 9.6	−0.6	+1.2	95	3 6.8	−0.1	+2.4	217
	1	q Tau	4.3	2 25.2	−0.3	+1.8	65	3 33.2	−0.8	+1.7	247
	1	20 Tau	4.1	2 42.9	−1.1	+1.0	101	3 39.4	−0.1	+2.8	210
	1	21 Tau	5.8	2 49.1	−0.4	+2.0	61	3 59.8	−1.0	+1.6	250
	1	22 Tau	6.5	2 51.6	−0.6	+1.8	70	4 2.6	−0.9	+1.8	241
	11	78 B.Vir	6.5	11 59.8	−1.1	−0.4	128	13 15.3	−1.3	−0.8	311
	28	7 Tau	5.9	4 51.4	−1.7	+2.7	40	6 12.4	−2.6	−1.1	279
	28	18 Tau	5.6	11 23.0	−0.5	+0.1	49	12 8.1	+0.8	−2.0	305
	28	q Tau	4.3	11 31.2	+1.2	−3.6	149	11 58.5	−0.9	+1.5	205
	28	21 Tau	5.8	11 40.3	+0.5	−1.9	121	12 26.7	0.0	−0.1	233
	28	22 Tau	6.5	11 46.5	+0.7	−2.2	129	12 27.5	−0.1	+0.2	224

Variable Stars

Monthly Report of the American Association of Variable Star Observers for July and August, 1933 (Concluded)

Following are the observations which for lack of space could not be included in the preceding issue. For the significance of the observers' initials, see page 460, of the October issue.

RAPIDLY VARYING IRREGULAR VARIABLES.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX ANDROMEDAE—						
	7150.6	11.4	Me	7272.5	11.6	Ry
	7153.6	11.6	Me	7273.5	12.2	Ry
	7225.5	11.6	Ry	7274.5	12.7	Ry
	7226.5	11.7	Ry	7274.9	12.6	Cy
	7229.5	12.2	Ry	7276.5	13.2	Ry
	7238.5	11.0	Ry	7276.9	13.3	Br
	7240.5	11.2	Ry	7277.5	13.0	Ry
	7245.8	13.2	Cy	7278.5	13.0	Ry
	7249.5	11.1	Ry	7278.9	13.3	Br
	7254.5	12.9	Ry	7279.6	13.1	Ry
	7254.9	12.5	Pt	7280.5	12.8	Ry
	7255.5	13.0	Ry	7281.5	11.2	Ry
	7256.9	12.7	Pt	7281.7	11.3	Pt
	7257.5	13.0	Ry	7282.7	11.5	Pt
	7258.5	13.0	Ry	7283.9	11.5	Br
	7260.5	11.2	Ry	7284.4	11.8	Ry
	7268.5	13.2	Ry	7284.7	11.7	Pt
	7270.5	11.1	Ry	7286.7	13.0	Pt
	7270.8	11.4	Pt	7288.9	12.7	Pt
	7271.7	11.6	Pt	7297.7	11.1	So
060547 SS AURIGAE—						
	7150.6	[13.5	Me	7249.5	[11.5	Ry
	7153.6	[13.4	Me	7249.6	[12.0	L
	7158.6	12.0	Me	7252.6	[12.5	L
	7159.6	12.6	Me	7254.9	[11.0	Pt
	7160.6	13.0	Me	7256.9	[12.6	Pt
	7197.1	[13.9	Bm	7257.8	[11.8	Cy
	7204.1	[13.9	Bm	7258.6	[12.5	L
	7207.1	[13.0	Bm	7259.6	[11.0	L
	7216.7	11.1	Me	7261.6	[11.5	L
	7225.4	[11.5	Ry	7268.5	[11.5	Ry
	7226.5	[11.5	Ry	7269.6	[11.5	L
	7229.5	[11.5	Ry	7270.6	11.0	L
060547 SS AURIGAE—						
	7271.9	11.2	Cy	7279.6	[11.5	Ry
	7272.6	11.3	L	7280.5	[12.5	Ry
	7272.8	11.4	Cy	7281.6	[12.5	L
	7273.6	11.9	L	7282.9	[12.5	Cy
	7274.9	12.3	Cy	7284.6	14.5	L
	7276.5	[11.0	Ry	7286.9	[12.6	L
	7277.5	[12.5	Ry	7288.9	[12.5	L
074922 U GEMINORUM—						
	7150.6	12.7	Me	7206.1	[13.7	Bm
	7152.6	13.5	Me	7207.1	14.0	Bm
	7158.6	[13.8	Me	7213.1	14.1	Bm
	7160.6	[13.5	Me	7219.1	14.1	Bm
	7197.1	[13.7	Bm	7226.4	[12.4	L
	7216.7	[13.0	Me	7227.4	[10.9	L
	7204.1	14.1	Bm	7228.4	[10.0	L
081473 Z CAMELOPARDALIS—						
	7150.6	13.2	Me	7234.6	12.3	Cy
	7152.6	10.6	Me	7236.7	12.7	Pt
	7153.6	10.4	Me	7237.7	12.8	Pt
	7158.6	10.3	Me	7238.5	13.1	Ry
	7159.6	10.3	Me	7238.8	12.7	Pt
	7160.6	10.6	Me	7240.5	11.0	Ry
	7216.7	12.5	Me	7241.6	11.1	Cy
	7217.8	12.5	Me	7242.4	10.8	L
	7218.7	12.7	Me	7242.5	10.8	Ry
	7225.4	11.0	Ry	7242.7	11.0	Cy
	7226.4	11.3	L	7243.4	10.8	L
	7226.5	11.6	Ry	7244.7	11.2	Cy
	7226.9	11.2	Cy	7245.6	11.8	Ko
	7227.4	11.3	L	7245.8	11.5	Cy
	7228.4	12.1	L	7246.4	11.5	L
	7229.5	12.6	Ry	7246.5	12.1	Ry

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1933.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
081473 Z CAMELOPARDALIS—							213843 SS CYGNI—						
	7246.6	12.1	Ko	7270.8	12.5	Pt		7226.6	8.5	Jo	7243.1	11.3	O
	7248.7	12.2	Cy	7271.4	13.0	Be		7226.9	8.3	Cy	7243.6	11.7	Fd
	7249.5	13.0	Ry	7271.4	13.1	L		7227.4	8.4	Ah	7243.6	11.3	L
	7250.4	13.1	L	7271.6	12.7	Cy		7228.4	8.0	Ah	7243.7	11.4	Mg
	7251.7	11.8	Pt	7271.7	12.5	Pt		7228.6	8.5	L	7243.8	11.6	We
	7253.4	12.8	L	7272.4	13.1	Be		7230.4	8.3	Ah	7244.4	11.4	Ah
	7254.4	13.2	L	7272.4	13.1	L		7230.6	8.3	Jo	7244.7	11.6	Cy
	7254.5	13.2	Ry	7273.4	13.1	L		7230.6	8.3	Wa	7244.8	11.6	We
	7254.7	12.5	Pt	7273.5	13.2	Ry		7232.6	8.2	Cy	7245.6	12.0	Ko
	7256.9	12.7	Pt	7273.7	12.7	Pt		7232.6	8.3	Jo	7245.6	11.5	Bc
	7257.4	12.9	L	7274.7	12.7	Pt		7234.6	8.2	Cy	7245.8	11.9	Cy
	7257.5	13.2	Ry	7275.7	12.7	Pt		7234.6	8.4	Wa	7245.8	11.6	We
	7257.9	12.7	Cy	7276.5	12.9	Ry		7234.6	8.3	Lg	7246.1	11.5	O
	7258.4	13.0	L	7277.5	12.8	Ry		7234.6	8.4	Jo	7246.5	11.7	L
	7258.5	13.2	Ry	7278.5	12.9	Ry		7234.7	8.3	Mg	7246.6	11.8	Sf
	7261.4	10.6	L	7279.4	12.9	L		7234.7	8.8	Ko	7246.6	11.8	Ko
	7262.4	10.7	L	7279.5	12.9	Ry		7235.5	8.7	Ah	7246.6	11.7	Jo
	7262.5	10.8	Ry	7280.5	12.7	Ry		7235.6	8.5	Jo	7247.1	11.9	O
	7263.4	10.6	L	7281.4	10.6	L		7235.7	9.2	Sg	7247.6	11.8	Jo
	7264.7	11.2	Pt	7281.5	10.8	Ry		7235.7	8.2	Mc	7247.6	11.9	Wa
	7265.4	11.5	L	7281.7	10.6	Pt		7236.4	8.8	Ah	7247.8	11.8	We
	7266.5	11.6	Ry	7282.4	10.6	L		7236.6	8.8	Jo	7248.5	11.8	L
	7266.6	11.5	L	7282.7	10.6	Pt		7236.7	8.3	We	7248.8	11.7	Cy
	7266.6	11.2	Cy	7284.3	10.8	L		7236.7	9.3	Pt	7248.8	11.8	We
	7266.7	11.5	Pt	7284.5	11.0	Ry		7237.6	8.8	Jo	7249.5	11.5	L
	7267.6	12.0	Cy	7284.7	11.1	Pt		7237.7	9.4	Pt	7250.5	11.6	L
	7268.5	12.1	Ry	7285.6	11.4	L		7237.7	8.5	Mc	7250.7	11.9	Pt
	7268.7	11.9	Pt	7286.7	11.5	Pt		7237.7	8.7	Mg	7251.6	11.8	Jo
	7269.7	12.0	Pt	7288.9	12.3	Pt		7237.8	9.2	Ko	7251.6	11.5	Bc
	7270.4	12.6	Br	7293.7	12.6	Pt		7237.8	9.5	Sg	7251.6	11.5	Bf
	7270.4	12.5	L	7297.7	11.8	Ar		7238.1	9.5	O	7251.6	11.5	L
	7270.5	12.9	Ry					7238.6	9.4	Jo	7251.7	12.0	Cy
094512 X LEONIS—								7238.7	9.0	Mc	7251.7	11.7	Pt
	7150.6	13.0	Me	7160.6	12.7	Me		7238.7	9.5	GD	7252.6	12.0	Cy
	7152.6	12.5	Me	7216.7	12.4	Me		7238.7	9.1	Cy	7252.6	11.6	L
	7153.6	12.6	Me	7218.7	12.6	Me		7238.7	9.4	Mg	7252.7	11.9	Mg
	7158.6	12.4	Me					7238.8	9.8	Pt	7253.4	11.8	L
202946 SZ CYGNI—								7239.1	9.9	O	7253.7	12.0	Mg
	7236.7	9.3	Pt	7270.8	9.3	Pt		7239.6	10.2	Ko	7254.4	11.8	L
	7237.7	9.5	Pt	7271.7	9.7	Pt		7239.6	9.8	Cy	7254.7	11.8	Pt
	7238.8	9.6	Pt	7273.7	9.3	Pt		7239.6	10.0	Hf	7255.7	11.9	Mg
	7239.7	9.5	Pt	7274.7	8.7	Pt		7239.7	10.3	Pt	7256.9	11.9	Pt
	7250.7	9.0	Pt	7275.7	9.0	Pt		7239.7	10.3	Mc	7257.4	12.1	L
	7251.7	9.4	Pt	7281.7	9.4	Pt		7239.7	9.7	Mg	7257.6	12.0	Wa
	7254.7	9.5	Pt	7282.7	9.6	Pt		7239.8	9.8	We	7257.7	11.5	Bc
	7256.9	9.5	Pt	7284.7	9.7	Pt		7240.4	10.2	Ah	7257.7	12.0	Cy
	7259.7	9.2	Pt	7285.7	9.6	Pt		7240.6	9.5	Lg	7258.4	12.1	L
	7264.7	9.0	Pt	7286.7	9.5	Pt		7240.7	10.2	Mg	7258.6	11.9	L
	7265.7	9.1	Pt	7288.9	9.2	Pt		7240.8	10.6	We	7259.6	11.8	L
	7266.7	9.4	Pt	7292.7	8.8	Pt		7241.6	11.2	Cy	7259.7	11.7	Pt
	7267.7	9.5	Pt	7293.7	8.9	Pt		7241.6	10.0	Bc	7261.4	11.7	L
	7268.7	9.7	Pt	7296.7	9.3	Pt		7241.7	10.8	Mg	7261.6	11.9	L
	7269.7	9.5	Pt					7241.7	10.9	Hf	7262.4	12.0	L
213843 SS CYGNI—								7241.8	11.3	We	7263.4	11.6	L
	7210.7	11.9	Cy	7216.8	11.9	Cy		7242.5	10.7	L	7263.6	11.8	Jo
	7211.8	11.7	Sg	7216.8	12.1	Me		7242.6	11.2	Sf	7263.6	11.9	Pi
	7212.9	11.9	Cy	7217.8	11.8	Me		7242.7	11.2	Mg	7264.7	11.6	Pt
	7214.9	11.7	Cy	7218.8	11.6	Me		7242.8	11.5	Cy	7264.7	12.0	Mg
	7215.6	11.8	Cy	7226.4	8.6	L		7242.8	11.6	We	7265.7	11.8	So

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1933.

Star	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.
213843 SS CYGNI—								213843 SS CYGNI—							
	7265.7	11.7	Pt		7271.7	11.9	Ar		7277.6	11.9	Jo		7284.5	12.0	Bg
	7265.8	12.0	El		7271.7	12.0	Cy		7277.6	12.3	Bg		7284.7	11.8	Bc
	7266.4	11.8	L		7271.8	12.0	Bh		7277.6	11.9	Wd		7284.7	11.7	Pt
	7266.6	11.9	Ko		7271.8	11.8	Br		7277.7	12.0	Cy		7284.7	11.8	Ar
	7266.6	12.0	Jo		7271.8	11.8	Pk		7278.4	11.8	L		7284.8	11.8	We
	7266.6	12.0	Pi		7271.8	11.6	We		7278.4	11.7	Be		7285.4	12.0	L
	7266.7	12.0	Cy		7272.4	11.8	Ah		7278.7	11.8	Bf		7285.4	11.8	Bc
	7266.7	11.7	Pt		7272.4	11.6	L		7278.7	11.9	El		7285.6	12.1	L
	7266.7	12.0	Mg		7272.6	12.0	L		7278.7	12.0	Ar		7285.7	11.7	Pt
	7266.7	12.0	El		7272.7	11.9	Gw		7278.8	11.9	Br		7286.7	11.7	Pt
	7266.7	12.0	Gr		7272.7	11.7	Ar		7279.7	11.9	Ar		7287.6	11.9	Jo
	7266.8	11.9	Bh		7272.8	11.8	We		7279.7	11.8	Bc		7288.9	11.5	Pt
	7267.6	11.7	Lg		7272.8	11.7	Cy		7279.8	11.4	Hl		7289.6	11.9	Wd
	7267.5	11.9	L		7273.6	11.7	Lg		7280.3	11.9	L		7289.7	11.9	Ra
	7267.7	11.7	Pt		7273.4	11.7	L		7280.6	11.7	Ar		7290.6	11.7	Wd
	7267.7	11.9	Cy		7273.5	11.7	L		7280.7	12.0	Br		7290.6	11.9	Hf
	7267.7	11.8	Bc		7273.6	11.8	Cy		7280.7	11.8	El		7291.6	11.9	C
	7268.6	11.8	Jo		7273.6	11.9	Jo		7281.3	11.8	L		7291.6	11.7	Bo
	7268.7	11.6	Pt		7273.7	11.9	Mg		7281.6	11.9	Wa		7291.6	11.9	Jo
	7268.8	11.7	Br		7273.7	11.6	Gr		7281.6	11.9	Jo		7291.6	11.6	Wd
	7269.6	11.9	L		7273.7	11.9	Wa		7281.7	11.7	Pt		7291.7	11.7	Ar
	7269.6	12.1	Bg		7273.7	11.8	Pt		7281.7	11.8	Ar		7292.6	11.7	Ar
	7269.7	11.8	Bc		7273.8	11.9	Pk		7282.4	11.7	L		7292.7	11.7	Pt
	7269.7	11.7	Pt		7273.8	11.8	We		7282.6	11.7	Sz		7293.6	11.9	Bg
	7269.8	11.8	Pk		7274.7	11.7	Pt		7282.6	11.8	Jo		7293.7	11.8	Pt
	7270.7	11.9	Bg		7274.8	11.8	Cy		7282.6	11.9	El		7293.7	11.9	Ar
	7270.7	12.0	Sg		7274.8	11.7	Br		7282.7	12.0	Bg		7294.6	11.4	Hf
	7270.7	11.9	El		7274.8	11.9	Ko		7282.7	11.7	Pt		7294.6	11.5	Wd
	7270.7	11.7	Mg		7275.6	11.9	Bg		7282.7	11.9	Ar		7296.7	11.7	Pt
	7270.7	11.7	Gr		7275.6	11.8	Wa		7282.8	11.8	We		7296.7	11.7	Ar
	7270.7	11.9	Fd		7275.7	11.9	Ko		7283.6	12.0	Wa		7297.6	11.6	Ar
	7270.7	11.8	So		7275.7	11.8	Cy		7283.6	11.9	Wd		7298.6	11.6	Ar
	7270.7	11.8	Ar		7275.7	11.8	El		7283.7	11.9	Pk		7299.6	11.5	Ar
	7270.8	11.7	Pt		7275.7	11.7	Pt		7283.7	11.8	Ar		7299.6	11.3	Sf
	7271.4	12.0	L		7275.7	12.0	Ar		7283.8	11.7	Br		7300.6	11.5	Ar
	7271.6	11.9	Jo		7276.7	11.9	Pk		7284.4	11.5	L		7302.6	11.3	Sf
	7271.7	11.8	Pt		7276.8	11.9	Br		7284.5	11.8	L				

Monthly Report of the American Association of Variable Star Observers for September, 1933

We are pleased to include in this report a few observations by Signor Eppe Loreta, co-discoverer with Mr. Peltier of the recent rise of Nova (RS) Ophiuchi. Sig. Loreta has applied for membership in the Association and sends these few observations as a prerequisite for membership. We welcome the addition to our ranks of such a versatile observer.

Nova (RS) Ophiuchi still continues to command the attention of observers, visually and photographically. Although in less than two months the star has decreased from 4th to 10th magnitude, due to the diligence of our observing members few details of the light changes have escaped attention. At this writing there is some evidence that the period of oscillations in light has been reached. For this reason alone the star should be followed as closely as possible during the next few weeks until it becomes too low in the west for observation. Late night observers will also be ready to observe it once it has passed into the early morning sky.

Variable Star Observations Received During September, 1933.

July 0 = J.D. 2427254; Aug. 0 = J.D. 2427285; Sept. 0 = J.D. 2427316.

S Scl

001032

J.D.Est.Obs.	
297	10.2 Ht
303	10.3 Ht
307	9.9 Ht
307	9.6 Pt
315	9.7 Ht

X And

001046

J.D.Est.Obs.	
300	12.4 Br

T Cet

001620

J.D.Est.Obs.	
310	6.9 An
315	6.8 L
325	6.6 Lr

T And

001726

J.D.Est.Obs.	
244	9.1 Gy
268	9.9 Gy
276	10.8 Gy
300	11.9 Gr
303	11.9 El
305	11.8 Br
307	12.0 Pt
308	12.0 El
314	12.4 Ch
326	12.7 Wd
326	12.6 Hf

T Cas

001755

J.D.Est.Obs.	
265	7.8 Ch
294	8.6 Ch
294	8.5 Ah
295	8.7 Mn
299	8.6 Ah
300	8.6 Jo
301	8.8 Ra
302	8.8 Hf
302	9.0 Mn
306	8.6 Ah
307	8.9 Jo
307	8.2 Pt
311	9.0 Jo
312	9.4 Wd
314	9.6 Jo
314	9.2 Ah
314	9.8 Mn
314	9.4 O
315	9.0 L
315	9.2 Wd
315	9.3 Hf
327	9.1 Mc
328	10.1 Wd
333	9.4 Mc
339	9.5 Mc

R And

001838

J.D.Est.Obs.	
280	10.3 Fd
299	10.9 Ah
300	11.8 Jo
301	11.0 Ra
302	11.5 Wd
303	11.4 An
303	11.3 El
307	11.4 Br
307	10.9 Pt
308	11.4 El
310	11.7 Wd
326	12.4 Wd
326	12.3 Hf

S Tuc

001862

J.D.Est.Obs.	
297	12.8 Ht
301	13.2 En
302	12.8 Ht
307	13.2 Ht

S Cet

001009

J.D.Est.Obs.	
303	8.9 El
307	9.0 Pt
308	9.3 El
309	9.4 Hf
310	9.1 An
314	9.6 Hf
315	9.5 L

T Phe

002546

J.D.Est.Obs.	
297	10.8 En
297	10.8 Ht
303	10.8 Ht
307	10.9 Ht
311	11.2 En

Y Cep

003179

J.D.Est.Obs.	
298	14.2 Br
307[	13.9 Br

U Cas

004047a

J.D.Est.Obs.	
249	10.3 Me
298	13.6 Br
307	14.1 Br
315	14.4 L

RW And

004132

J.D.Est.Obs.	
300	13.3 Br
306[	13.1 Gr

V And

004435

J.D.Est.Obs.	
311	9.8 O
312	9.5 Jo
314	9.7 Jo
315	10.3 L

RR And

004533

J.D.Est.Obs.	
300	10.8 Br
303	10.6 El
308	10.3 El
311	10.3 O
312	9.6 Jo
314	9.6 Jo

RV Cas

004746a

J.D.Est.Obs.	
305	14.4 Br

— Cas

004746b

J.D.Est.Obs.	
307	10.7 Pt

W Cas

004958

J.D.Est.Obs.	
283	10.8 Fd
299	10.6 Ah
300	10.7 Gr
300	10.5 Jo
303	10.8 El
307	11.0 Pt
307	10.8 Jo
308	10.8 El
310	10.8 Ko
312	10.8 Jo
315	10.9 Jo
315	11.0 Hf
315	11.0 Wd
315	10.5 Ra

U Tuc

005475

J.D.Est.Obs.	
278	12.0 Sl
297	12.9 Ht
301	12.9 En
302	13.0 Ht
307	13.1 Ht

Z Cet

010102

J.D.Est.Obs.	
303	12.2 El
307	12.2 Pt
308	12.3 El
315	12.7 L

U And

010940

J.D.Est.Obs.	
276[	12.5 Gy
303	14.1 El
305	13.3 Br
315	14.0 L
327	13.2 Me

UZ And

011041

J.D.Est.Obs.	
303	11.1 El
315	11.5 L

S Psc

011208

J.D.Est.Obs.	
303	13.5 El
305	13.2 Br
315	12.7 L

S Cas

011272

J.D.Est.Obs.	
296	9.4 Br
297	9.4 Th
300	9.5 Jo
302	9.4 Gr
302	9.7 Hf
302	9.5 Ko
305	9.7 Th
307	8.5 Pt
307	9.6 Jo
311	9.4 Jo
311	9.3 Ko
313	9.5 Th
314	9.5 O
314	8.6 Jo
318	8.4 Ra

U Psc

011712

J.D.Est.Obs.	
276	11.3 Gy
303	11.1 El
305	11.1 Br
307	11.5 Pt
312	11.5 Jo
315	11.7 L

RZ Per

012350

J.D.Est.Obs.	
302	10.2 Gr
303	10.8 El
305	10.5 Br
312	10.5 O
312	10.1 Jo
315	10.3 L

R Psc

012502

J.D.Est.Obs.	
305	7.8 Br
307	8.0 Pt
309	8.8 Hf
311	8.2 Jo
314	8.0 Jo
314	8.2 Ah
314	8.3 Hf
326	8.2 Gy

RU And

013238

J.D.Est.Obs.	
276	10.6 Gy
297	10.6 Cy
305	11.1 Br
307	10.8 Pt
307	11.5 Jo
309	10.6 Cy
312	11.8 Jo
315	11.3 L

Y And

013338

J.D.Est.Obs.	
276[	11.5 Gy
305	14.2 Br
315	14.4 L

X Cas

014958

J.D.Est.Obs.	
293	12.3 Bn
301	11.9 Jo
305	12.3 Bn
307	11.7 Jo
307	12.1 Pt
311	12.3 Bn
312	11.8 Jo
315	12.3 Bn

U Per

015254

J.D.Est.Obs.	
286	8.5 Ry
294	7.8 Ah
295	8.3 Ry
298	8.3 Ah
299	8.2 Ah
300	8.2 Jo
300	8.2 O
303	8.3 El
305	8.3 Ry
306	8.0 Ah
307	8.0 Jo
307	8.0 Pt
308	7.7 El
309	8.3 Hf
309	8.3 Ry
309	8.5 Cy
311	8.0 Jo
313	8.0 Ah
314	8.2 Jo
315	7.9 Ah
327	8.3 Sq
327	7.8 Mc
333	8.0 Mc
339	8.3 Mc

S Ari

015912

J.D.Est.Obs.	
305	13.6 Br
315	12.8 L
326	11.7 Gy

R Ari

021024

J.D.Est.Obs.	
283	8.4 Fd
290	8.2 Ah
294	8.0 Ah
298	8.2 Ah
299	8.4 Ah
300	8.0 Jo
305	8.7 Br
306	8.5 Ah
307	8.8 Jo
307	8.7 Pt
309	9.3 Hf
311	9.0 Jo
313	8.7 Ah
314	8.7 Jo
314	8.8 Ah
314	9.4 Hf
315	9.1 L

R Ari

021034

J.D.Est.Obs.	
315	9.0 O
315	9.0 Ah

W And

021143a

J.D.Est.Obs.	
276	8.7 Gy
294	7.8 Ah
298	7.8 Ah
299	7.7 Ah
300	7.5 O
300	7.8 Jo
302	7.1 Gr
305	7.9 Ah
305	7.4 Br
306	7.7 Ah
307	7.2 Pt
311	7.5 O
311	7.9 Jo
312	7.8 Ah
312	7.5 Ra
314	7.5 Jo
314	8.2 Ah
315	8.0 Ah
325	7.6 Ra
326	8.0 Gy

T Per

021258

J.D.Est.Obs.	
257	9.2 Hr
294	8.9 Ah
300	8.6 Jo
300	9.1 Wd
303	8.8 El
307	8.8 Jo
307	8.7 Pt
309	9.2 Hf
310	9.0 Wd
314	8.5 Jo
314	8.9 Ah
328	8.7 Wd
329	9.0 Lr

Z Cep

021281

J.D.Est.Obs.	
307[	14.4 Br

o Cet

021403

J.D.Est.Obs.	
282	8.2 Cy
284	8.2 Cy
300	7.8 Jo
307	8.3 Jo
307	9.0 Pt
309	9.0 Hf
310	9.0 Cy
311	8.5 Jo
314	8.7 Jo
314	9.2 Ah
314	9.0 Hf
315	9.1 L
318	9.2 Ra

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1933.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S PER	R TRI	X CET	T CAM	R LEP	RR TAU
021558	023133	*031401*	043065	*045514*	053326
257 9.5 Hr	314 6.7 Ah	314 11.5 Jo	300 9.0 Jo	308 6.4 Pt	154 11.4 Mi
290 8.9 Sz	314 6.6 Jo	316 10.7 L	302 9.3 O	V ORI	306 12.8 Br
294 9.2 Ah	314 6.6 O	Y PER	305 9.2 Gr	050003	307 12.2 Pt
294 8.9 Pk	315 6.6 Ah	032043	307 8.8 Jo	308 10.2 Pt	308 12.0 Pt
297 9.3 Pk	318 6.6 Ra	294 8.9 Ah	307 9.0 Br	316 10.3 L	308 12.4 Br
297 9.5 Cy	325 6.2 Ra	298 9.0 Ah	307 9.4 Pt	T LEP	311 12.8 L
300 9.0 Jo	326 6.4 Gy	299 9.0 Ah	308 9.2 El	*050022*	316 12.5 L
300 9.2 Wd	T ARI	300 8.5 Jo	310 9.5 Hf	308 12.3 Pt	RU AUR
301 9.0 Pk	024217	300 8.9 Gr	311 8.8 Jo	S PIC	053337
303 9.0 El	300 9.1 Jo	300 8.5 O	314 9.2 Jo	*050848*	307 13.7 Br
307 9.1 Pt	311 9.4 Jo	301 9.0 Pk	314 9.5 Hf	307 11.2 Ht	308 13.5 El
307 9.2 Jo	314 9.4 Jo	306 9.0 Ah	316 9.1 L	R AUR	U AUR
309 9.6 Hf	315 9.7 O	307 8.3 Jo	RX TAU	050953	053531
309 9.4 Cy	327 10.0 Me	307 8.3 Pt	043208	305 13.4 Br	308 10.5 Br
310 9.2 Wd	W PER	308 8.4 El	303 12.3 El	308 12.8 Pt	308 10.2 Pt
311 9.0 Jo	024356	310 9.0 Hf	308 12.6 Pt	T PIC	316 11.5 L
314 9.1 Jo	283 9.1 Fd	311 8.4 Jo	316 13.0 L	*051247*	SU TAU
314 9.3 Ah	295 9.0 Ry	314 8.1 Jo	R RET	307 13.1 Ht	054319
319 8.4 Ra	297 9.1 Cy	314 9.0 Ah	*043263*	S AUR	307 9.6 Pt
327 9.7 Me	300 9.0 Jo	315 8.5 O	297 11.9 Ht	052034	308 9.6 Pt
328 9.3 Wd	305 9.0 Ry	317 8.3 Sq	303 11.9 Ht	283 10.3 Fd	308 9.5 Br
338 9.6 Sz	307 8.6 Jo	333 8.4 Mc	307 11.8 Ht	308 10.8 El	311 9.6 L
R CET	307 8.8 Pt	339 8.4 Mc	X CAM	308 10.4 Pt	316 9.5 L
022000	308 8.9 El	R PER	043274	314 9.9 Jo	325 9.6 Pt
307 8.9 Jo	309 9.1 Cy	032335	212 11.4 Ch	W AUR	U ORI
309 9.4 Hf	309 8.6 Ry	283 9.6 Fd	297 8.9 Cy	052036	054920a
311 9.0 Jo	310 8.9 Hf	300 9.9 Jo	306 10.3 Gr	146 13.2 Mi	308 12.4 Pt
314 8.9 Jo	311 8.7 Jo	303 10.0 El	307 10.0 Jo	283 9.6 Fd	314 11.6 Jo
316 8.7 L	312 8.8 O	305 10.0 Br	307 10.0 Br	305 11.4 Br	V CAM
RR PER	314 8.4 Jo	307 10.4 Pt	308 10.3 El	308 11.5 El	054974
022150	327 8.8 Me	307 10.1 Jo	308 10.5 Pt	308 11.6 Pt	307 13.5 Br
303 14.1 El	327 9.5 Mc	308 10.3 El	309 10.2 Cy	316 11.8 L	308 13.6 Pt
305 14.0 Br	333 9.2 Mc	311 10.2 Jo	311 10.3 Jo	S ORI	Z AUR
316 14.2 L	339 9.0 Mc	314 10.4 Jo	314 10.6 Jo	*052404*	055353
U CET	R HOR	316 10.6 L	314 10.8 O	308 9.3 El	300 10.7 Jo
022813	*025050*	NOV PER	316 10.7 L	308 9.3 Pt	304 11.2 Pt
307 11.2 Pt	297 7.1 Ht	032443	R DOR	314 9.8 Jo	307 10.5 Pt
316 10.7 L	303 7.0 Ht	307 13.0 Pt	*043562*	T ORI	307 10.8 Jo
RR CEP	307 6.8 Ht	R TAU	297 4.9 Ht	*053005a*	308 11.1 El
022980	315 6.9 Ht	042209	303 5.3 Ht	307 10.0 Pt	311 11.0 Jo
298 13.5 Br	T HOR	290 11.8 Ma	307 5.3 Ht	308 9.9 Pt	314 11.2 Jo
307 12.5 Pt	*025751*	307 11.9 Pt	R CAE	309 9.6 Ma	325 10.2 Pt
R TRI	297 12.4 Ht	W TAU	*043738*	309 10.1 L	337 11.1 Mc
023133	303 12.2 Ht	042215	307 11.8 Ht	314 11.2 Jo	339 10.9 Mc
276 8.5 Gy	307 12.1 Ht	283 10.8 Fd	R PIC	316 10.1 L	R OCT
290 7.8 Ah	U ARI	300 10.7 Jo	*044340*	AN ORI	*055686*
294 7.7 Ah	030514	303 11.0 El	307 7.3 Ht	*053005t*	278 11.1 Sl
298 7.6 Ah	276 8.3 Gy	307 11.0 Pt	V TAU	309 11.5 Ma	293 11.0 En
299 7.6 Ah	303 9.0 El	307 10.8 Jo	044617	S CAM	295 11.2 Ht
300 7.3 Jo	305 8.0 Br	310 11.3 Cy	303 9.7 El	053068	302 11.2 Ht
301 7.2 Ra	316 9.4 L	311 11.4 Jo	306 9.8 Br	307 8.2 Jo	307 11.1 Ht
306 7.2 Ah	X CET	314 11.0 Jo	307 10.2 Jo	308 8.7 El	315 11.2 Ht
307 6.9 Jo	*031401*	316 11.8 L	308 9.2 Pt	308 8.5 Pt	X AUR
307 6.9 Pt	303 11.3 El	S TAU	311 10.0 Jo	311 8.1 Jo	060450
309 7.0 Hf	307 11.0 Pt	042309	314 9.8 Jo	314 8.4 Jo	197 9.2 Ch
310 6.6 Wd	307 11.7 Jo	307 11.7 Pt	R ORI	314 8.9 Hf	213 8.5 Ch
311 6.7 Jo	308 11.2 El	311 11.9 Jo	045307		305 13.5 Br
312 6.7 Ah	311 11.8 Jo		316 12.3 L		308 12.9 Pt

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V AUR	T GEM	Y DRA	W VEL	RS CEN	T UMA
061647	074323	093178	*101153*	*111661*	123160
213 8.9 Ch	197 8.4 Ch	283 11.7 Cy	294 9.5 En	293 12.5 En	333 12.2 Ma
276 10.7 Gy	221 9.0 Ch	297 12.0 Cy	295 10.0 Ht	295 12.2 Ht	R VIR
308 11.0 El	U PUP	304 12.6 Cy	300 10.1 Ht	300 12.1 Ht	123307
U LYN	*075612*	307 12.7 El	300 9.8 En	300 11.2 En	243 8.9 Ch
063159	115 8.7 Mi	R LMI	306 10.0 Ht	306 10.5 En	249 8.3 Me
306 10.3 Br	R CNC	093934	U HYA	306 10.8 Ht	274 7.0 Bh
308 10.4 El	081112	213 10.4 Ch	*103212*	315 10.1 Ht	290 8.2 Sz
S LYN	211 7.0 Ch	243 7.4 Ch	X CEN	295 6.8 Bh	
063558	V CNC	R LEO	RZ CAR	*114441*	299 7.4 Pt
221 12.6 Ch	081617	094211	*103270*	293 12.6 En	300 7.7 Hf
308 14.2 El	211 8.6 Ch	206 9.2 Ch	293 11.3 En	295 12.8 Ht	301 7.5 Ra
308 13.5 Pt	R CHA	238 9.7 Ch	295 10.8 Ht	300 13.1 Ht	305 7.4 Rc
R LYN	*082476*	L CAR	300 10.4 Ht	300 12.6 En	RS UMA
065355	278 8.8 Sl	*094262*	300 10.4 En	AD CEN	123459
308 10.9 El	292 8.8 En	278 3.6 Sl	306 10.2 En	*114858*	257 13.4 Ma
R GEM	295 8.8 Ht	Z VEL	315 10.2 Ht	295 9.5 Ht	272 12.5 Ma
070122a	300 8.4 Ht	*094953*	R UMA	300 9.4 Ht	285 11.8 Ch
197 9.6 Ch	300 8.7 En	278[12.8 Sl	103769	306 9.5 Ht	288 10.9 So
213 10.3 Ch	305 8.7 En	295[12.8 Ht	203 9.3 Ch	315 9.5 Ht	289 11.2 Ry
308 12.9 Pt	306 8.5 Ht	V LEO	243 10.6 Ch	W CEN	293 11.2 Bn
Z GEM	315 8.5 Ht	095421	244 10.1 Gy	*115058*	294 10.3 Ah
070122b	U CNC	206 12.6 Ch	259 10.7 Gy	292 10.2 En	294 11.2 Ry
308 12.5 Pt	083019	210[13.5 Mi	263 11.0 Gy	295 10.9 Ht	297 11.2 Bn
TW GEM	211 10.6 Ch	RR CAR	274 11.0 Bh	300 11.2 Ht	299 10.6 Ah
070122c	S HYA	*095458*	276 11.4 Gy	300 10.9 En	299 10.9 Wd
308 8.3 Pt	084803	295 7.9 Ht	295 11.2 Bh	306 11.7 En	299 11.2 Pt
330 8.2 Lr	211 12.8 Ch	300 7.9 Ht	297 11.9 Cy	306 11.4 Ht	299 10.8 Sh
R VOL	T HYA	306 7.7 Ht	299 12.0 Pt	315 11.9 Ht	300 10.7 Jo
070772	*085008*	315 7.7 Ht	299 11.7 Wd	R CRV	302 10.9 Wd
307 12.6 Ht	147 10.5 Mi	RV CAR	302 11.7 Wd	*121418*	305 10.8 Bn
L_2 PUP	211 7.8 Ch	*095563*	304 11.7 Cy	278 8.6 Sl	305 10.5 Ry
071044	T CNC	293[13.1 En	307 12.2 El	SS VIR	306 10.0 Ah
277 6.0 Sl	085120	300[13.1 Ht	310 11.8 Wd	122001	307 10.2 Jo
RR MON	211 8.5 Ch	306[13.1 Ht	311 12.1 El	244 8.3 Md	308 10.5 Bn
071201	W CNC	S CAR	314 11.9 Wd	T CVN	309 10.3 Ry
115[12.9 Mi	090425	*100661*	314 11.8 Sh	122532	310 10.3 Wd
V GEM	211 12.5 Ch	278 6.3 Sl	325 11.5 So	299 11.0 Pt	310 10.4 Ma
071713	RW CAR	285 6.2 En	326 12.5 Hf	307 10.5 Cy	311 10.2 El
175 11.8 Mi	*091868*	295 6.0 Ht	326 12.4 Wd	308 10.8 Rc	311 10.1 Jo
206 10.8 Ch	292[12.8 En	300 5.8 Ht	338[11.5 Sz	325 10.0 Rc	311 10.5 Bn
S CMI	300[12.8 Ht	300 6.3 En	V HYA	U CEN	312 10.3 Ry
072708	306[12.8 Ht	306 5.5 Ht	*104620*	*122854*	313 9.8 Ah
206 8.0 Ch	R CAR	U UMA	212 7.0 Ch	293[12.3 En	314 9.8 Ah
T CMI	*092962*	100860	243 7.0 Ch	300[12.3 Ht	314 9.9 Hv
072811	278 7.5 Sl	212 6.6 Ch	W LEO	306[12.3 En	314 9.9 Wd
206 11.2 Ch	292 8.5 En	220 6.8 Hr	104814	T UMA	314 9.7 Mn
S VOL	294 8.8 En	229 6.9 Hr	206 13.8 Ch	123160	314 9.9 Sh
073173	295 8.7 Ht	235 6.9 Hr	RS CAR	212 9.6 Ch	315 10.0 Jo
307 9.5 Ht	300 8.7 Ht	248 6.9 Hr	*110361*	243 11.7 Ch	315 10.4 Bn
U CMI	306 8.9 Ht	295 6.5 Mn	300[12.3 En	244 11.3 Gy	318 9.9 Wd
073508	X HYA	302 6.5 Mn	S LEO	257 11.9 Ma	318 9.8 Hf
206 10.9 Ch	*093014*	310 6.6 Mn	110506	272 12.4 Ma	325 9.5 So
S GEM	211 11.7 Ch	Z CAR	206 12.6 Ch	285 12.5 Ch	326 9.7 Hf
073723	Y DRA	*101058a*	RY CAR	288 13.0 So	326 9.5 Wd
191 9.1 Ch	093178	295[12.6 Ht	*111561*	299 12.8 Pt	326 9.9 Gy
211 10.1 Ch	212 9.5 Ch	300[12.3 Ht	293[13.1 En	308 12.7 El	333 9.1 Ma
308[12.4 Pt	238 10.2 Me	306[12.3 Ht	300[13.1 Ht	311 12.8 El	333 8.9 Mc
	275 11.0 Cy		306[13.1 En	314 9.8 Hv	337 9.3 Mc

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S UMA	V CVN	RT CEN	R CEN	V Boo	R Boo
123961	131546	*134236*	*140959*	142539a	143227
238 7.2 Ch	297 8.6 Th	295 10.2 Ht	305 6.7 En	299 7.8 Hf	313 7.9 Ah
244 8.0 Gy	305 8.7 Th	300 10.4 Ht	306 6.2 Ht	299 7.4 Pt	314 7.5 Jo
257 7.8 Ma	308 8.8 Th	305 10.6 Ht	314 6.0 En	299 7.3 An	314 7.5 Ch
259 7.7 Gy	311 8.6 Th	306 11.0 En	315 6.2 Ht	300 7.6 Jo	315 8.0 Ra
263 8.5 Gy	313 8.7 Th	315 11.1 Ht	U UMi	300 7.7 Hv	315 7.8 Ah
268 8.5 Gy	R HYA	R CVN	141567	302 7.5 Mn	316 7.6 Hf
272 8.2 Ma	*132422*	134440	274 11.4 Ma	306 7.7 Ah	328 7.6 Hf
276 8.9 Gy	197 4.2 Ch	197 10.5 Ch	294 12.0 An	307 7.4 Jo	338 8.0 Sz
283 8.7 Fd	206 4.3 Ch	288 9.6 So	296 12.4 Hi	308 7.8 GD	S LUP
285 8.7 Ch	211 4.8 Ch	290 10.7 Sz	297 12.2 Cy	309 7.5 An	*144646a*
288 8.5 So	221 5.0 Ch	299 10.3 Pt	299 12.0 Pt	310 7.2 Wd	294 12.5 En
294 9.1 Ah	243 5.6 Ch	300 10.2 Hv	300 11.5 Jo	311 7.4 Jo	300 12.4 Ht
295 9.4 Mn	285 7.0 Ch	306 10.0 Ah	306 11.6 Ah	313 7.9 Ah	305 11.8 En
298 9.2 Ah	294 7.3 En	313 10.0 Ah	307 12.2 Cy	314 8.0 Hv	306 11.5 Ht
299 9.5 Ah	295 7.6 Ht	325 9.7 So	308 13.0 El	314 7.8 Cy	X LUP
299 9.3 Hf	300 7.8 Ht	338 9.0 Sz	309 12.3 Ma	314 7.5 Jo	*144646b*
299 9.9 Wd	306 7.8 Ht	RX CEN	312 11.8 Jo	314 7.4 Ch	294 12.5 En
299 9.8 Sh	306 7.6 En	*134536*	315 11.6 Jo	314 7.4 Mn	300[12.1 Ht
299 9.8 Pt	315 8.3 Ht	294 9.6 En	321 12.4 Hi	315 8.0 Ra	306 12.1 Ht
300 9.7 Jo	S VIR	295 9.7 Ht	333 11.2 Ma	315 8.1 Ah	U Boo
301 9.8 Ra	*132706*	300 9.7 Ht	338 10.8 Sz	315 7.7 Pa	144918
301 9.9 An	197 10.9 Ch	306 9.7 Ht	S Boo	316 7.9 Hf	297 11.2 Cy
302 10.0 Wd	243 9.5 Ch	306 10.0 En	141954	318 7.8 Sq	307 11.2 Cy
302 9.9 Mn	285 6.8 Ch	315 9.6 Ht	276 11.7 Gy	327 8.4 Me	308 10.9 El
306 10.1 Ah	290 7.0 Sz	T APS	292 10.6 Ch	328 8.6 Sf	311 11.1 El
307 10.5 Jo	294 6.3 En	*134677*	299 10.1 Pt	328 8.3 Hf	314 11.0 Cy
308 10.4 El	295 6.3 Ht	293 10.7 En	299 10.5 An	329 8.3 Mc	Y LUP
310 10.5 Ma	295 6.6 Bh	295 11.0 Ht	300 10.0 Jo	R CAM	*145254*
310 10.3 Rb	299 6.6 Hf	302 11.7 Ht	300 10.3 Wd	142584	294[13.7 En
310 10.3 Wd	299 6.2 Pt	305 11.2 En	307 10.0 Jo	208 10.6 Ch	300[12.8 Ht
311 10.7 Jo	300 6.4 Ht	307 11.6 Ht	309 10.4 An	243 8.9 Ch	305[13.7 En
311 10.4 El	306 6.3 Ht	RR VIR	310 10.2 Wd	275 9.1 Md	S APS
312 10.5 O	306 6.0 En	*135908*	311 10.0 Jo	294 8.3 Ch	*145971*
313 10.6 Ah	315 6.6 Ht	246 12.7 Mi	314 9.7 Jo	296 8.6 Hi	278 10.3 Sl
314 10.0 Hv	RV CEN	299 11.7 Pt	314 10.0 Ch	298 8.7 Br	293 10.5 En
314 10.6 Wd	*133155*	Z Boo	315 9.8 Be	307 8.6 Br	294 10.4 En
314 10.5 Sh	294 8.4 En	140113	315 9.8 L	307 9.4 Cy	295 10.2 Ht
314 10.1 Mn	295 9.1 Ht	277 10.0 Ma	323 9.8 Ra	312 8.6 Jo	300 10.1 Ht
315 10.6 Jo	300 9.0 Ht	306 9.3 Gr	326 9.3 Gy	314 8.6 Jo	300 10.2 En
318 10.7 Hf	305 8.6 En	311 9.5 El	RS VIR	314 9.2 Hv	305 10.4 En
318 10.7 Wd	306 9.1 Ht	Z VIR	142205	314 9.3 O	306 10.2 Ht
325 10.6 So	315 9.5 Ht	*140512*	302 7.6 Ko	R Boo	315 10.2 Ht
326 10.7 Wd	T UMi	299[12.2 Pt	311 7.5 Ko	143227	RT LIB
326 11.2 Gy	*133273*	RU HYA	V Boo	221 12.8 Ch	*150018*
326 10.8 Hf	308 13.9 El	*140528*	142539a	290 8.9 Sz	299[12.9 Pt
333 11.6 Ma	311 13.7 El	294 10.6 En	249 8.8 Me	291 8.7 Ah	T LIB
333 11.3 Mc	T CEN	295 10.9 Ht	265 7.9 Ch	292 8.7 Ch	*150519*
338 11.5 Sz	*133633*	300 10.7 Ht	266 8.4 Cy	294 8.6 Ah	207[13.2 Ch
U OCT	278 7.1 Sl	306 10.9 Ht	275 7.7 Cy	297 8.5 Hf	244[13.2 Ch
131283	294 7.4 En	306 10.7 En	280 7.4 Fd	298 8.4 Ah	299[12.9 Pt
293 9.4 En	295 6.9 Ht	315 10.9 Ht	283 7.4 Cy	299 8.3 Hf	S LIB
295 9.5 Ht	300 6.6 Ht	R CEN	290 7.2 Ah	299 8.0 Pt	*151520*
302 9.4 Ht	306 6.2 Ht	*140959*	294 7.4 Ah	300 8.0 Jo	207 10.9 Ch
305 9.3 En	306 6.5 En	278 6.7 Sl	294 7.8 Pk	300 8.3 Wd	244 9.5 Ch
307 9.2 Ht	315 6.0 Ht	292 6.9 En	295 7.6 Mn	306 8.1 Ah	S SER
315 8.7 Ht	RT CEN	294 6.7 En	295 7.3 Fd	307 7.4 Jo	151714
	134236	295 6.5 Ht	295 7.5 Bh	310 8.1 Wd	207[13.0 Ch
	294 10.4 En	300 6.3 Ht	298 7.4 Ah	311 7.7 Jo	277 12.3 Ma

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J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
S SER			S UMI			R CRB			R CRB			R CRB			X CRB		
151714			153378			154428			154428			154428			154536		
299	12.3	Pt	208	8.6	Ch	268	5.9	Me	301	5.9	Mg	314	5.9	Pt	299	8.9	Pt
306	12.3	Cy	238	8.8	Ch	268	6.0	Se	302	6.0	Wd	314	5.9	Ru	301	9.0	Jo
308	12.1	El	249	9.7	Me	268	6.0	Gy	302	5.9	Mn	314	6.1	Ch	306	9.0	Cy
311	12.2	El	265	10.0	Ch	271	5.9	Me	302	6.0	O	314	5.9	Mc	310	8.6	Ma
S CRB			294	10.5	Ch	272	5.8	Me	302	6.1	Ko	315	6.0	Mc	310	9.1	Sf
151731			294	10.6	Ah	274	5.6	Me	302	5.8	Hu	315	5.9	Ru	312	8.9	Jo
207	13.2	Ch	299	10.7	Sq	274	6.0	Cy	302	5.8	Ru	315	6.0	Jo	313	9.4	L
238	13.4	Ch	299	11.2	Pt	275	6.0	Cy	303	6.0	Hf	315	6.1	Ah	314	9.3	Cy
290	11.1	Sz	300	11.0	Jo	275	5.6	Me	303	5.8	Pt	315	6.0	Hf	320	9.5	Hi
295	10.7	Bh	306	11.0	Ah	276	5.9	Gy	303	6.1	An	315	6.0	L	328	9.7	Sf
297	12.1	Rl	307	10.4	Sq	277	6.0	Cy	303	5.8	Ru	315	5.8	Pa	333	10.4	Ma
299	11.5	Sq	307	11.5	Jo	282	6.0	Cy	304	5.6	Pt	315	6.0	Bc	R SER		
299	11.3	Pt	310	12.1	Ko	282	6.0	Ch	304	5.9	Ra	316	6.0	Be	154615		
300	10.5	Jo	311	11.7	Jo	283	6.0	Cy	304	5.8	Cy	316	6.0	L	207	11.8	Ch
300	11.5	El	314	11.7	Jo	284	6.0	Cy	304	5.5	Rc	316	5.9	Pt	238	13.0	Ch
307	10.5	Jo	326	10.8	Sq	285	6.0	Cy	304	6.2	An	316	5.8	Ru	295	11.6	Bh
308	10.4	El	T NOR			286	6.0	Cy	305	6.0	Be	317	5.8	Pt	297	11.9	Cy
309	10.8	Sf	*153654*			286	5.9	Ko	305	6.0	Gy	318	6.0	Ra	299	12.8	Cy
310	10.5	Ko	294	11.9	En	288	5.9	Ko	305	6.1	An	318	5.9	Ru	299	11.5	Pt
311	10.4	Jo	295	11.6	Ht	289	5.8	Ba	305	6.0	Ru	319	5.8	Ru	300	10.3	Jo
311	10.2	Ch	300	11.3	Ht	290	6.1	Sz	305	6.0	Mg	320	5.9	Sx	307	11.0	Cy
314	9.7	Jo	305	10.8	En	290	5.9	Ah	306	6.1	Ah	320	5.8	Ru	310	11.1	Rb
325	8.4	Sq	306	10.7	Ht	291	5.5	Rb	306	6.0	Cy	321	5.9	Pt	310	11.3	Wd
326	8.9	Ba	315	10.2	Ht	293	5.9	Bh	306	6.0	Bh	321	6.1	Me	311	11.2	Ch
328	8.8	Sf	R CRB			293	5.8	Gy	306	5.9	Pt	322	5.9	Me	314	11.0	Cy
329	8.6	Mc	154428			294	5.9	Bh	307	6.0	Jo	322	5.9	Sx	338	9.8	Sz
337	8.3	Mc	203	6.2	Ch	294	6.0	Ah	307	5.7	Pt	322	5.9	Ru	V CRB		
338	8.0	Sz	207	6.2	Ch	294	6.2	Se	308	6.1	Be	323	5.9	Pt	154639		
339	8.3	Mc	212	6.0	Ch	294	5.9	Ch	308	5.8	Pt	323	5.9	Sx	207	9.2	Ch
RS LIB			212	5.9	Hr	295	6.0	Bh	308	6.1	An	323	6.0	Ra	241	8.8	Md
151822			215	5.9	Hr	295	6.0	Be	309	5.8	Ru	324	5.9	Sx	265	8.1	Md
294	8.9	En	216	5.9	Hr	295	5.8	Mn	309	5.9	Ko	324	5.9	Pt	275	8.0	Cy
297	8.6	Ht	220	5.9	Hr	296	6.0	Bh	310	5.9	Ko	325	5.4	Rc	288	7.5	So
302	8.2	Ht	228	5.9	Hr	296	5.9	Ra	310	6.0	Cy	326	5.9	Ba	294	7.3	Ah
306	8.7	En	229	5.9	Hr	297	6.0	Hf	310	5.9	Pa	326	6.0	Hf	294	7.8	Pk
307	8.3	Ht	231	5.9	Hr	297	5.9	Bc	310	5.8	Pt	326	5.8	Gy	297	7.5	Th
315	8.2	Ht	233	5.9	Hr	297	6.0	Cy	310	6.0	Rb	327	6.0	Mc	297	7.7	Hf
RU LIB			234	5.9	Hr	297	5.8	Ru	310	6.1	Se	327	6.0	Hu	298	7.4	Th
152714			235	5.9	Hr	298	5.9	Pt	311	5.8	Ru	327	5.6	Me	299	7.3	Ah
207	11.4	Ch	235	6.2	Ch	298	5.9	Bc	311	6.0	Jo	328	6.0	Hf	299	7.8	Sq
244	10.0	Ch	236	5.9	Hr	298	5.8	Ru	311	5.8	Ko	328	5.9	Ba	299	7.0	Pt
299	7.7	Hf	238	5.7	Me	299	5.9	Pt	311	6.0	Cy	329	6.0	Mc	300	7.5	Jo
299	8.1	Pt	243	6.1	Ch	299	5.9	Bh	312	6.0	Jo	333	5.8	Mc	300	8.0	Hv
303	8.7	An	244	5.8	Gy	299	6.0	Ah	312	6.0	Ah	335	5.9	Mc	305	7.7	Th
R NOR			248	5.9	Hr	299	6.0	Ba	312	6.0	O	336	5.9	Mc	306	7.8	Cy
152849			249	5.9	Hr	299	6.1	Sh	312	6.0	Ru	337	5.8	Mc	307	7.4	Jo
294	9.6	En	249	6.0	Me	299	5.9	Pa	312	5.8	Mc	338	6.1	Sz	308	7.7	Th
295	10.2	Ht	251	5.9	Hr	299	6.0	Hu	313	5.8	Mc	339	6.0	Mc	309	7.8	Th
300	9.9	Ht	253	5.9	Hr	299	6.1	An	313	5.8	Pt	340	6.0	Mc	311	7.9	Th
305	9.5	En	257	5.9	Hr	299	5.7	Ru	313	6.0	Ru	341	5.9	Mc	311	7.4	Jo
306	9.7	Ht	258	5.9	Hr	299	5.9	Wd	313	6.0	Be	X CRB			313	7.9	Th
315	9.0	Ht	259	5.9	Hr	300	6.0	Jo	313	6.0	L	154536			314	7.6	Cy
W LIB			263	5.9	Gy	300	5.8	Pt	314	5.8	Jo	207	13.0	Ch	314	7.5	Ah
153215			264	6.1	Se	301	6.1	Jo	314	6.1	Ah	257	9.4	Ma	314	7.0	Jo
207[	13.4	Ch	264	6.1	Me	301	6.0	Be	314	5.9	Wd	266	9.4	Cy	314	7.8	Hv
246[	13.4	Mi	265	6.0	Se	301	6.0	Bh	314	5.9	Mn	272	9.2	Ma	320	7.6	Hi
			267	6.0	Se	301	5.8	Pt	314	6.0	Ko	275	9.3	Cy	325	7.9	So
			267	6.0	Me				314	6.0	Cy	297	9.3	Cy	325	7.3	Sq

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1933.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V CrB	R Her	SX Her	W CrB	W Her	R Dra
154639	160118	160325	161138	163137	163266
329 7.5 Mc	276 9.7 Gy	314 8.6 Wd	326 12.0 Al	204 10.6 Ch	311 7.9 Jo
337 7.7 Mc	282 9.6 Cy	314 8.8 Sh	W Oph	221 11.6 Ch	312 7.8 Ah
339 7.7 Mc	299 9.2 Pt	314 8.5 Pt	*161607*	238 12.4 Ch	314 8.5 Jo
R Lib	299 9.2 Hf	316 8.2 Pt	211 13.0 Ch	257 13.3 Ma	314 7.7 Mn
154715	300 9.7 Jo	316 8.6 Hf	300[12.0 Pt	272 13.4 Ma	315 7.7 O
207 13.0 Ch	306 9.3 Cy	317 8.2 Pt	V Oph	300 12.4 Rl	315 8.0 Wd
244[13.5 Ch	307 9.4 Jo	320 8.0 Sq	*162112*	300 12.8 Pt	315 7.9 Ah
R Lup	310 9.3 Ko	321 8.4 Me	211 7.2 Ch	303 12.8 El	315 8.0 Hf
154736	310 8.7 Sf	321 8.2 Pt	290 8.0 Sz	308 12.2 El	328 8.4 Hf
278 13.5 Sl	311 8.9 Jo	322 8.3 Me	294 8.8 Ch	333 11.5 Ma	328 8.3 Hv
294[12.6 En	314 9.3 Cy	323 8.1 Pt	296 9.1 Bh	R UMi	328 8.4 Wd
305[13.0 En	314 9.3 Jo	324 8.0 Pt	300 8.2 Pt	163172	333 8.2 Ma
RR Lib	315 9.0 Hf	325 8.0 Lr	300 8.5 Hf	249 9.3 Me	RR Oph
155018	315 9.1 Wd	325 8.0 Me	312 8.4 O	299 9.8 Sq	*164319*
277[13.5 Ma	321 9.2 Al	325 8.0 Sq	338 9.5 Sz	300 9.7 Jo	300 12.0 Pt
299[12.7 Pt	326 9.5 Gy	327 8.1 Me	U Her	300 9.9 Hf	306 11.9 En
Z CrB	328 9.5 Sf	328 8.3 Wd	162119	304 9.5 Be	S Her
155229	U Ser	328 8.3 Hf	204 9.1 Ch	307 9.8 Sq	164715
213 9.6 Ch	160210	331 8.1 Lr	238 10.4 Ch	307 9.6 Jo	208 10.4 Ch
271 12.6 Cy	257 13.0 Ma	336 8.4 Mc	244 10.8 Hu	309 9.5 L	221 10.7 Ch
275 12.8 Md	272 11.8 Ma	RU Her	244 10.8 Ar	311 9.8 Jo	300 12.2 Pt
308 13.7 El	280 11.0 Fd	160625	244 10.6 Gy	314 9.9 Jo	301 12.5 Jo
311 14.0 El	282 10.9 Cy	213 13.6 Ch	259 10.6 Gy	314 10.0 Hv	307 12.4 Jo
RZ Sco	297 9.2 Cy	238 13.5 Ch	276 11.4 Gy	315 9.7 Hf	310 12.0 Cy
155823	297 9.0 Bc	257 13.3 Ma	294 11.3 Ch	315 9.7 Wd	311 12.4 Jo
294 12.2 En	299 9.0 Pt	272 12.8 Ma	299 11.7 Hu	326 9.9 Sq	314 12.2 Jo
297 12.5 Ht	304 8.9 Cy	297 12.1 Cy	300 11.5 Wd	328 10.3 Hv	RS Sco
299 12.3 Pt	311 8.8 Cy	299 12.0 Pt	300 11.1 Pt	337 10.6 Mc	*164844*
302 12.2 Ht	321 8.4 Al	299 11.0 Sq	309 11.7 Cy	R Dra	294 12.0 En
306 12.2 En	328 8.6 Wd	306 11.1 Cy	310 11.8 Wd	163266	300 12.0 Mg
307 12.0 Ht	333 7.8 Ma	307 11.2 Sq	311 11.8 Ar	213 12.1 Ch	303[12.0 Ht
Z Sco	SX Her	310 11.2 Wd	313 11.8 Ar	238 11.5 Ch	306 12.0 En
160021	160325	313 11.6 L	314 12.0 Ar	249 11.0 Me	RR Sco
244 10.0 Hu	238 7.9 Me	314 11.3 Sh	320 11.8 Hi	257 9.3 Ma	*165030a*
244 10.0 Ar	249 8.0 Me	314 11.1 Wd	325 12.2 Ar	272 8.8 Ma	278 6.6 Sl
249 9.9 Ar	297 8.3 Hf	314 11.2 Cy	327 12.3 Ar	280 8.1 Fd	295 6.8 En
249 9.9 Hu	298 8.1 Pt	327 10.9 Me	327 12.2 Hu	290 7.7 Ah	297 7.1 Ht
294 9.6 En	299 8.0 Pt	328 11.0 Wd	SS Her	294 7.8 Ah	303 7.0 Ht
297 9.5 Ht	299 8.2 Sq	333 10.8 Ma	162807	294 8.0 Ch	306 7.2 En
302 9.8 Hu	300 8.1 Pt	R Sco	211 12.4 Ch	295 8.3 Fd	307 7.0 Ht
302 10.1 Ar	301 8.3 Pt	*161122a*	300 12.4 Jo	295 7.8 Mn	315 7.3 Ht
302 9.7 Ht	301 8.5 An	294[12.6 En	300 11.6 Rl	298 7.8 Ah	SS Oph
302 10.2 Gw	303 8.5 Hf	300[12.6 Pt	300 11.6 Pt	299 7.9 Wd	*165202*
303 9.4 An	303 8.3 Pt	307[12.6 Ht	301 11.4 An	299 7.8 Sh	211 8.2 Ch
304 10.1 Gw	304 8.3 Pt	S Sco	303 11.7 El	300 7.7 Jo	265 10.9 Md
304 10.2 Ar	306 8.5 Pt	*161122b*	310 12.2 Cy	300 7.6 Hf	300[12.5 Pt
305 10.3 Ar	307 8.2 Pt	294[12.6 En	311 12.7 Jo	300 7.8 Pt	320[12.0 Hi
306 10.1 Ar	307 8.2 Sq	300[12.6 Pt	313 12.1 L	301 8.0 Ra	RV Her
306 9.9 En	308 8.2 Pt	303[12.6 Ht	315 12.4 Wd	302 7.7 Wd	165631
306 10.1 Gw	309 8.8 Ko	307[12.6 Ht	T Oph	302 7.7 Mn	204[13.3 Ch
307 10.1 Ar	310 8.8 Ko	W CrB	*162815*	303 7.7 El	249 10.5 Md
307 9.5 Ht	310 8.4 Wd	161138	213 9.4 Ch	305 7.9 Ah	298 10.3 El
308 10.2 Ar	310 8.5 Pt	241 9.0 Md	300[12.0 Pt	306 7.8 Ah	299 10.3 An
308 10.0 Gw	310 8.2 An	249 8.6 Me	S Oph	307 7.8 Jo	300 10.1 Pt
315 9.8 Ht	311 8.3 Jo	300 9.8 Jo	*162816*	309 7.8 Ma	300 10.3 Jo
325 9.7 Rc	313 9.0 L	300 10.3 Pt	213[13.2 Ch	310 8.1 Wd	302 11.0 Mg
	313 8.5 Pt	307 10.5 Jo		311 7.7 Hv	304 11.1 Be
	314 8.3 Jo	312 11.2 Jo			307 10.5 Jo

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J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
RV HER			R OPH			S OCT			T DRA			T HER			W LYR		
165631			*170215*			*172486*			175458a			180531			181136		
308	10.9	An	321	7.8	Ar	302	9.2	Ht	314	12.6	El	312	8.7	Jo	311	9.4	Jo
309	11.1	L	321	7.6	Gw	305	9.3	En	UY DRA			313	8.6	Ah	312	9.6	Hf
312	11.3	Jo	325	7.0	Rc	307	9.7	Ht	175458b			314	8.5	Jo	313	9.2	Ah
315	11.7	Jo	326	7.6	Gy	315	10.2	Ht	207	11.8	Ch	314	8.9	Hf	314	9.2	Jo
326	12.3	Al	326	7.8	Gw	RU OPH			213	11.8	Ch	315	8.7	Ah	314	9.6	Hf
RT SCO			328	7.7	Hv	172809			221	11.7	Ch	316	8.7	El	314	9.0	Hv
165636			333	8.0	Mc	211	13.6	Ch	238	11.0	Ch	320	8.2	Al	315	9.1	Ah
295[	13.0	En	336	8.1	Mc	244	11.6	Gy	291	11.7	Mi	322	8.4	Me	315	8.9	Be
306[	13.0	En	RT HER			249	11.0	Md	303	10.8	El	325	8.2	Ra	315	8.9	L
R OPH			170627			257	10.5	Ma	310	10.6	Cy	326	7.8	Gy	320	9.3	Al
170215			211	10.0	Ch	259	9.9	Gy	314	10.9	El	328	8.1	Ba	323	9.4	Ra
211	12.8	Ch	302	13.4	Mg	263	9.8	Gy	RY HER			W DRA			325	9.2	So
243	10.5	Ch	303	13.6	El	268	9.5	Gy	175519			180565			326	9.1	Hf
243	10.1	Hu	308	13.5	El	*272*	9.3	Ma	208	12.0	Ch	221	11.8	Ch	326	9.1	Wd
243	10.1	Ar	311	14.0	Pf	*276*	9.2	Gy	213	11.7	Ch	292[	14.1	Br	327	8.8	Al
244	10.1	Ar	324	14.5	Pf	300	9.0	Pt	221	11.1	Ch	301[	12.9	Pt	328	9.0	Sf
244	10.0	Hu	RW SCO			301	9.4	An	244	9.5	Ch	305[	14.1	Br	RV SGR		
244	9.9	Gy	*170833*			301	8.8	Jo	257	9.2	Ma	X DRA			*182133*		
249	10.0	Hu	295[	12.5	En	304	9.1	Be	272	9.4	Ma	180666			295[	13.6	En
249	10.0	Ar	Z OPH			307	8.8	Jo	300	10.2	Jo	221	11.5	Ch	307	13.0	En
263	9.6	Gy	171401			309	9.1	L	300	10.4	Pt	292[	14.1	Br	SV HER		
268	9.4	Gy	244	8.5	Hu	311	9.5	An	304	11.3	Be	301[	11.3	Pt	182224		
276	8.8	Gy	244	8.6	Ar	311	8.7	Jo	309	11.2	L	305[	14.1	Br	249	9.5	Me
285	8.2	Ch	249	8.2	Me	314	8.7	Jo	309	10.8	Ma	TV HER			300	12.5	Br
294	7.7	Ch	294	8.3	Ah	326	10.3	Al	312	11.6	Jo	181031			301	12.6	Pt
297	7.6	Ru	300	8.4	Hf	RU SCO			314	11.9	Jo	309	10.3	L	303	12.7	El
299	7.8	An	300	8.2	Pt	*173543*			333	13.2	Ma	RY OPH			316	13.6	El
300	7.6	Hf	301	8.2	Jo	297	10.2	En	V DRA			181103			T SER		
300	7.8	Hv	305	8.2	Gs	SV SCO			175654			275	9.2	Md	182306		
300	7.4	Pt	306	8.8	Ah	*174135*			221	10.9	Ch	290	8.2	Sz	298	13.6	Br
301	7.7	Jo	307	8.0	Jo	295	9.9	En	238	11.7	Ch	290	8.2	Ah	SV DRA		
301	7.5	Ra	309	8.5	Cy	W PAV			300[	13.1	Pt	294	8.1	Ah	183149		
302	7.7	Hu	311	8.3	Jo	*174162*			R PAV			298	8.2	Ah	257	14.3	Ma
302	7.6	Ar	314	8.4	Jo	295[	13.0	En	*180363*			299	8.2	Ah	272	14.2	Ma
302	7.5	Gw	315	8.7	Hf	302[	13.0	Ht	295	7.8	En	300	8.3	Hf	309	12.6	Ma
302	7.3	Ru	315	8.8	Wd	307	13.0	En	297	7.9	Ht	301	8.4	Jo	333	10.2	Ma
303	7.6	Ar	315	9.0	Ah	U ARA			302	8.0	Ht	306	8.1	Ah	RZ HER		
304	7.8	Ar	318	8.9	Ra	*174551*			307	8.1	Ht	312	8.5	Jo	183225		
304	7.8	Gw	320	8.0	Al	295	11.1	En	307	8.1	En	314	8.9	Ah	297[	13.3	Br
305	7.0	Sq	RS HER			297	11.2	Ht	315	8.4	Ht	314	8.7	Jo	307[	13.4	Br
305	7.8	Ar	171723			302	12.4	Ht	T HER			320	9.2	Al	X OPH		
305	8.2	Gs	241	12.2	Md	307	12.2	Ht	180531			329	9.4	Mc	183308		
306	7.8	Ar	288	11.8	So	307	12.3	En	213	11.2	Ch	336	9.8	Mc	208	7.3	Ch
306	7.5	Gw	300	11.7	Jo	RT OPH			244	13.1	Ch	338	11.9	Sz	243	8.4	Ch
307	7.8	Ar	300	11.7	Pt	175111			276	12.1	Gy	W LYR			249	8.2	Me
307	7.5	Jo	307	11.0	Jo	211[	12.8	Ch	294	10.7	Ah	181136			275	9.0	Cy
308	7.8	Ar	310	10.8	Cy	300	9.8	Pt	299	10.2	Ah	294	9.8	Ah	284	8.9	Cy
308	7.7	An	311	10.6	Jo	304	9.5	Be	299	10.9	An	299	9.7	Ah	296	9.0	Bh
308	7.8	Gw	314	10.4	Jo	309	9.5	L	299	9.8	Hu	300	9.6	Jo	301	8.7	Jo
311	7.3	Jo	315	10.5	Ah	T DRA			300	9.8	Hf	300	10.2	Hv	301	8.8	Ra
311	7.6	Ar	320	9.6	Al	175458a			300	10.0	Hv	300	9.5	Rl	301	8.6	Pt
311	7.2	Ru	320	10.0	Hi	207	11.1	Ch	300	10.4	Pt	301	9.8	Pt	302	8.5	Mn
313	7.6	Ar	325	10.0	So	213	11.1	Ch	303	9.6	El	302	9.9	So	307	8.8	Jo
314	7.7	Ar	S OCT			221	11.3	Ch	303	8.5	Ra	305	9.5	Ah	310	8.8	Ko
314	7.3	Jo	*172486*			238	11.0	Ch	306	9.4	Ah	306	9.3	Ah	311	8.4	Jo
315	7.9	Hf	278	8.9	Sl	291	12.0	Mi	307	9.3	Jo	307	9.4	Jo	314	8.5	Jo
315	8.1	Wd	293	9.2	En	303	12.6	El	308	9.1	An	309	9.3	An	314	8.4	Mn
317	7.6	Sq	295	8.9	Ht	310	12.5	Cy	309	8.9	L	310	9.4	Wd	315	8.5	L

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J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
X OPH		R SCT		R SCT		R SCT		RX LYR		R AQL	
183308		*184205*		*184205*		*184205*		185032		190108	
315	8.5 Be	295	5.8 Fd	308	6.0 GD	325	6.1 Rc	303[	14.2 Ar	267	6.3 Se
325	8.4 Rc	296	6.0 Bc	308	6.0 An	325	6.1 Me	305[	14.1 Br	268	6.3 Se
RS DRA		296	6.1 Ra	308	6.1 Pt	325	5.9 Hf	308[	13.5 Ar	285	7.0 Ch
184074		297	6.0 Hf	309	5.8 Pt	325	6.1 Sq	310[	14.0 Ar	291	7.9 Ah
208	11.2 Ch	297	6.0 Bc	309	6.0 An	325	5.9 Ar	311	14.5 Ar	294	7.9 Ah
RY LYR		297	5.9 Cy	309	5.9 Hf	325	5.8 Ra	*327*[	13.4 Ar	295	8.1 Mn
184134		298	6.0 GD	309	5.9 Wd	326	6.0 Hf	S CRA		296	8.0 Ra
244[	13.3 Ch	298	6.3 Ra	309	6.0 L	326	6.1 Gy	*185437a*		299	8.2 Ah
301[	12.5 Pt	298	6.0 Bc	309	5.3 Cy	326	5.8 Gw	278	11.6 Sl	301	8.4 Jo
R SCT		298	6.2 Pt	310	5.9 Mn	327	5.9 Ar	295	11.3 En	301	8.5 Pt
184205		299	5.9 Wd	310	5.8 Pa	327	5.9 Mc	297	11.5 Ht	302	9.2 Mn
212	7.0 Ch	299	5.7 Pa	310	5.7 Ko	327	6.1 Me	302	11.7 Ht	302	8.4 O
220	6.0 Hr	299	5.8 Cy	310	5.4 Cy	328	6.1 Hf	305	11.7 En	306	8.6 Ah
228	5.9 Hr	299	5.7 Hu	310	5.7 Se	328	5.7 Hv	307	11.4 En	308	8.3 Gs
234	5.8 Hr	299	6.0 GD	310	6.1 Ra	328	6.0 Wd	307	11.6 Ht	310	8.0 Ra
235	5.8 Hr	299	5.9 An	310	6.1 An	328	6.1 Ar	ST SGR		310	9.5 Mn
238	5.8 Me	299	5.9 Pt	311	5.5 Ar	329	6.1 Mc	*185512a*		310	8.0 Ko
243	5.6 Ch	300	5.3 Jo	311	6.1 An	333	6.0 Ma	285[	12.5 Ch	311	8.2 Jo
244	5.0 Gy	300	5.8 Pt	311	5.7 Ch	333	6.1 Mc	301[	12.6 Mg	314	8.5 Jo
248	5.4 Hr	301	5.9 Mg	311	5.5 Jo	335	6.0 Mc	R CRA		314	8.9 Ah
249	5.2 Me	301	6.0 An	311	5.8 Hv	336	6.2 Mc	*185537a*		331	11.1 So
251	5.4 Hr	301	5.8 Pt	311	5.2 Cy	337	6.3 Mc	278	11.7 Sl	V LYR		
254	5.3 Hr	301	5.0 Jo	312	5.5 Jo	338	6.1 Mc	295	10.7 En	190529a		
255	5.1 Ma	301	6.1 L	312	5.7 Sq	339	6.4 Mc	297	10.3 Ht	301	8.9 Pt
257	5.2 Ma	302	5.6 Be	312	6.0 O	340	6.4 Mc	302	10.0 Ht	305	9.0 Br
257	5.3 Hr	302	5.9 Mn	312	6.0 Ra	341	6.4 Mc	305	11.1 En	RX SGR		
259	5.4 Hr	302	5.8 Bc	312	6.0 An	RW LYR		307	10.5 En	*190818*		
259	5.3 Gy	302	5.6 Ar	312	6.0 Pt	184243		307	10.3 Ht	274[	13.1 Ma
263	5.7 Gy	302	5.6 Gw	312	6.0 Mc	*296*[	14.2 Br	T CRA		285[	13.1 Ch
263	5.4 Se	302	5.8 Pt	313	6.0 Mc	305[	14.2 Br	*185537b*		297[	12.7 Ht
264	5.4 Se	303	5.6 Ar	313	5.8 Pt	Nov AQL		278	12.5 Sl	301[	12.4 Pt
264	5.6 Me	303	6.0 GD	313	5.5 Ar	184300		305	12.5 En	307[	12.7 Ht
265	5.5 Se	303	5.9 Pt	313	6.0 GD	*257*	10.5 Ma	307	13.0 En	RW SGR		
267	5.6 Se	303	5.9 Hf	313	5.7 Be	*268*	10.5 Gy	Z LYR		*190819a*		
267	5.7 Me	303	5.9 Bc	314	5.9 Hf	*276*	10.6 Gy	185634		274	9.8 Ma
268	5.7 Me	303	6.1 Bf	314	5.7 Jo	284	11.2 Cy	244[	13.8 Ch	285	9.9 Ch
268	5.6 Se	304	6.1 Bc	314	5.8 Wd	299	11.6 Pt	300	13.9 Br	295	10.3 En
268	5.7 Gy	304	6.1 Bf	314	5.8 Bc	301	11.4 Jo	301	13.1 Pt	297	10.5 Ht
271	5.6 Me	304	5.6 Cy	314	5.9 Ko	307	11.1 Jo	SU SGR		301	10.6 Pt
272	5.6 Me	304	5.9 Rc	314	5.5 Ar	311	10.8 Jo	*185722*		302	10.6 Ht
273	5.4 Ma	304	6.2 An	314	5.8 Pt	314	11.0 Jo	297	8.5 Ht	307	10.6 Ht
274	5.3 Ma	304	5.8 Pt	314	6.0 Mc	323	11.5 Pt	302	8.5 Ht	TY AQL		
274	5.9 Me	305	5.9 Pt	315	5.5 Jo	*326*	10.4 Gy	307	8.5 Ht	*190907*		
275	5.9 Me	305	5.8 Rc	315	5.9 Bc	*333*	10.8 Ma	RT LYR		238	10.6 Me
276	6.0 Gy	305	5.9 Mg	316	6.1 Bc	RX LYR		185737		274	10.5 Ma
277	6.0 Ma	305	6.1 An	316	6.0 Pt	185032		300	13.1 Br	277	10.5 Ma
278	5.6 Sl	305	6.1 Gs	317	5.9 Pt	243	12.7 Hu	303	13.0 El	301	10.5 Pt
280	5.7 Fd	305	5.9 Sq	320	6.0 Sx	243	12.6 Ar	308	13.3 El	*322*	10.4 Me
285	5.8 Cy	305	6.0 Gy	320	6.0 Ra	244	13.1 Ar	316	14.0 El	331	9.1 So
286	5.9 Cy	305	6.0 Bc	321	6.1 Me	244	13.1 Hu	V AQL		S LYR		
290	5.9 Bc	306	5.7 Be	321	5.9 Pt	244	12.8 Ch	*185905*		190925		
292	6.0 Bc	306	5.8 Cy	322	5.9 Ra	249	12.8 Hu	295	7.8 Mn	244[	12.6 Gy
292	5.8 Ch	306	6.2 An	322	6.1 Me	249	12.8 Ar	302	7.8 Mn	297	14.2 Br
293	6.0 Gy	306	6.1 Pt	322	5.9 Sx	250	12.7 Ar	314	7.8 Mn	307	14.2 Br
294	6.3 Bc	307	6.0 An	323	5.8 Sx	254	12.8 Ar	R AQL		X LYR		
294	6.1 Se	307	6.1 Pt	323	5.9 Pt	257	12.8 Ar	190108		190926		
295	5.7 Be	307	6.0 Jo	324	5.9 Pt	269	13.3 Ar	208	7.9 Ch	212	9.2 Hr
295	5.8 Mn	307	5.9 Bc	324	5.8 Sx	292[	14.1 Br	243	6.3 Ch	235	9.2 Hr

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1933.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
X LYR	R SGR	S SGR	RT AQL	RT CYG	χ CYG
190926	*191019*	*191319a*	193311	194048	194632
254 9.3 Hr	297 8.4 Ht	249[13.0 Hu	333 12.9 Ma	315 8.1 Ah	310 10.8 Ma
301 8.9 Pt	299 9.0 Hu	285 12.0 Ch	R CYG	315 8.1 Hf	310 10.9 Wd
RS LYR	300 9.1 Hf	295 11.8 En	193449	315 8.1 Wd	311 10.8 Ch
190933a	300 8.7 Wd	297 11.6 Ht	208 12.2 Ch	326 8.4 Wd	312 10.1 Hv
268 12.5 Gy	301 8.6 Ra	300 11.8 Wd	274 13.3 Ma	326 8.7 Gy	314 10.5 Jo
276 12.2 Gy	301 9.0 Pt	301 11.6 Ra	293 13.4 Br	326 8.5 Hf	326 9.7 Gy
294 11.9 Br	302 8.9 Hu	301 11.8 Pt	303 13.7 El	333 9.1 Ma	328 9.7 Wd
301 11.7 Pt	302 8.8 Ht	302 11.5 Ht	303 13.5 Pt	TU CYG	333 8.8 Ma
315 11.2 L	307 8.8 En	307 11.4 En	308 13.8 El	194348	S PAV
316 11.3 Be	307 8.8 Ht	307 11.2 Ht	309 13.8 Ma	208 9.1 Ch	*194659*
326 11.2 Gy	310 9.6 Ko	310 11.6 Wd	311 13.9 El	237 10.4 Ch	295 7.5 En
RU LYR	310 9.7 Wd	326 11.0 Wd	312 10.0 Hv	265 11.4 Ch	307 7.6 En
190941	314 9.9 Sh	326 10.9 Hf	333 13.5 Ma	274 13.0 Ma	RR SGR
293[13.3 Br	314 9.7 Wd	327 11.1 Me	RV AQL	282 12.8 Ch	*194929*
301[13.8 Pt	326 10.2 Hf	327 10.9 Hu	193509	293 14.2 Br	307 12.4 En
U DRA	326 10.2 Wd	327 11.0 Ar	303 10.9 Pt	308 14.4 El	311 12.0 En
190967	327 10.2 Me	Z SGR	316 10.1 L	311 14.6 El	RU SGR
208 9.5 Ch	327 10.8 Hu	*191321*	316 10.1 Be	333[12.6 Ma	*195142*
243 9.9 Ch	327 10.8 Ar	295[12.4 En	T PAV	X AQL	295 8.8 En
283 11.4 Fd	RY SGR	307[12.4 En	*193972*	194604	297 8.4 Ht
285 11.8 Ch	*191033*	SW SGR	295 12.4 En	283 8.6 Fd	302 8.7 Ht
298 12.3 Br	237 10.2 Ch	*191331*	297 12.4 Ht	291 8.7 Ah	307 8.9 Ht
301 11.5 An	249 10.4 Me	295 11.9 En	302 12.8 Ht	294 8.9 Ah	307 9.2 En
301 12.4 Pt	278 9.4 Sl	307 11.5 En	307 13.0 Ht	297 9.2 Hf	311 9.4 En
303 12.3 Pf	292 8.0 Bh	TZ CYG	307 13.0 En	297 8.9 Th	RR AQL
305 12.2 Br	292 8.8 Ch	191350	RT CYG	298 8.8 Th	*195202*
310 12.3 Pf	293 8.7 En	282 10.4 Ch	194048	298 9.0 Ah	296 12.9 Br
311 12.5 Pf	295 8.8 En	301 10.3 Pt	237 11.0 Ch	299 8.9 Hf	305 12.9 Br
316 12.8 Be	296 9.1 Bh	U LYR	244 9.4 Gy	303 8.8 Pt	NOV CYG
316 12.8 L	297 9.1 Bh	191637	259 8.7 Gy	305 9.1 Th	195553
324 12.9 Pf	297 8.6 Ht	238 12.1 Me	263 8.5 Gy	306 9.5 Ah	282[13.2 Ch
W AQL	298 8.7 Pt	301 12.2 Pt	265 8.5 Ch	307 9.2 Th	324[12.2 Pt
191007	299 9.1 Bh	327 12.1 Me	274 7.5 Ma	309 9.2 Th	RR TEL
274 9.4 Ma	299 8.8 Pt	AF CYG	276 8.0 Gy	309 9.2 Sf	*195656*
277 9.2 Ma	300 9.0 Mg	192745	283 7.3 Fd	311 9.5 Th	297[12.8 Ht
285 8.7 Ch	300 9.1 Pt	264 6.9 Se	292 7.1 Ch	313 9.7 Th	301[12.6 En
301 8.2 Pt	300 8.8 En	268 6.9 Se	294 7.4 Ah	314 9.6 Ah	311[12.6 En
311 9.2 Jo	301 9.0 Bh	294 7.1 Ah	296 6.8 Ra	316 9.5 Be	Z CYG
316 8.4 Be	301 8.9 Pt	298 7.5 Ah	297 7.8 Hf	316 9.5 L	195849
316 8.2 L	302 8.8 Pt	299 7.4 Ah	299 7.5 Ah	320 9.7 Hi	237 11.2 Ch
322 8.7 Me	302 8.5 Ht	306 7.2 Ah	299 7.5 Sh	322 10.2 Ra	282 13.2 Ch
T SGR	303 9.0 Pt	312 7.0 Ra	299 7.6 Wd	326 10.0 Hf	303[12.5 Pt
191017	304 9.1 Pt	314 7.4 Ah	300 6.8 Jo	326 10.2 Wd	S TEL
244 10.8 Hu	305 8.8 En	315 7.3 Ah	302 7.6 Hf	328 10.6 Sf	*195855*
244 10.9 Ar	306 8.9 En	320 7.0 Ra	302 7.5 Wd	329 10.7 Mc	297 12.8 Ht
285 11.8 Ch	306 9.0 Pt	325 7.2 Ra	303 7.2 Pt	336 11.0 Mc	301 12.8 En
301 11.7 Pt	306 9.1 Bh	TY CYG	303 7.2 El	χ CYG	302 12.6 Ht
302 10.6 Hu	307 8.8 Pt	192928	304 7.0 Ra	194632	307 12.7 Ht
R SGR	307 8.6 Ht	282 12.9 Ch	306 7.6 Ah	274 12.9 Ma	311 12.8 En
191019	308 8.9 Pt	297 14.0 Br	308 7.6 El	282 13.0 Ch	SY AQL
237 7.0 Ch	311 9.2 Ch	RT AQL	310 7.8 Ko	292 11.8 Ch	200212
238 7.5 Me	311 8.6 En	193311	310 8.0 Ra	297 11.8 Br	296 13.2 Br
244 7.8 Hu	321 9.2 Pt	274 11.1 Ma	310 7.7 Wd	299 12.3 Wd	303 12.7 Pt
244 7.8 Ar	323 9.5 Pt	282 11.0 Ch	311 7.5 Jo	300 11.0 Jo	306 12.2 L
249 7.9 Hu	324 9.4 Pt	300 12.0 Br	311 7.9 El	303 11.9 El	S CYG
249 7.6 Me	S SGR	301 12.1 Pt	312 8.1 Hv	303 12.0 Pt	200357
285 8.2 Ch	*191319a*	309 12.2 Ma	314 7.5 Jo	307 10.8 Jo	282 12.2 Ch
295 8.4 En	244[13.5 Ar	310 12.2 Ma	314 8.0 Ah	308 11.3 El	292 11.8 Ch

Variable Star Observations Received During September, 1933.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S Cyg	**RS Cyg**	**WX Cyg**	**RU Cap**	**T Del**	**R Vul**
200357	200938	201437b	*202622*	204016	205923a
303 10.6 El	282 8.2 Cy	315 11.1 Wd	297[12.0 En	294 13.9 Br	300 8.1 Jo
303 11.2 Pt	282 7.4 Ah	315 11.2 Hf	311[12.0 En	303[12.9 Pt	301 8.7 Hf
308 11.3 El	299 7.8 Sh	326 11.3 Hf	**Z Del**	309 13.8 L	303 8.4 Pt
311 10.6 El	299 8.1 Wd	326 11.1 Wd	202817	311 13.5 Ch	306 8.7 Ah
R Cap	300 7.4 Jo	**V Sge**	274[13.1 Ma	**W Aqr**	307 8.6 Jo
200514	301 8.3 Hf	201520	305[14.4 Br	*204104*	312 9.4 Jo
303 11.8 Pt	302 8.5 Wd	321 11.5 Me	311[13.1 Ch	309 10.2 Cy	312 9.4 Jo
311 11.5 Ch	303 8.6 Ra	322 11.3 Me	333 12.4 Ma	**U Cap**	313 9.6 Ah
S Aql	303 7.4 Pt	325 11.9 Me	**ST Cyg**	*204215*	315 9.9 Ah
200715a	304 8.0 Cy	327 12.1 Me	202954	311[12.7 Ch	315 9.5 Jo
238 11.2 Me	306 7.5 L	238 12.2 Me	282 13.0 Ch	**V Del**	**V Cap**
249 11.0 Me	307 7.4 Jo	249 12.1 Me	296 14.0 Br	204318	*210124*
285 9.3 Ch	309 8.4 Cy	**U Cyg**	303 13.1 Pt	274 11.4 Ma	300[12.7 En
300 9.0 Jo	310 8.4 Wd	201647	305 13.8 Br	294 11.3 Br	**TW Cyg**
301 9.5 An	310 7.7 Ko	208 7.9 Ch	306 13.7 L	302 11.3 Mg	210129
303 9.2 Pt	311 7.2 Ch	249 7.3 Me	**V Vul**	305 11.2 Br	282 12.8 Ch
309 9.4 Cy	311 7.4 Jo	265 7.2 Ch	*203226*	309 11.8 L	296 12.8 Br
310 9.6 An	314 7.3 Jo	268 7.3 Se	303 8.8 Pt	311 11.8 Ch	305 12.9 Br
311 9.4 Jo	314 8.2 Cy	282 6.8 Ch	**R Mic**	333 11.8 Ma	306 13.0 L
314 9.3 Jo	315 8.3 Wd	291 7.2 Pk	*203429*	**T Aqr**	**X Cap**
322 9.7 Me	315 8.5 Hf	295 7.4 Mn	297[12.8 En	*204405*	*210221*
RW Aql	326 8.4 Wd	296 7.1 Ra	311[12.8 En	283 10.0 Fd	303[12.4 Pt
200715b	326 8.6 Hf	298 7.7 GD	**Y Del**	303 11.8 Pt	**X Cep**
300 9.0 Jo	**R Del**	299 7.6 Sh	203611	309 12.0 Cy	210382
303 9.3 Pt	201008	299 7.1 Pa	296 13.7 Br	314 12.4 Ch	208 8.7 Ch
311 8.8 Jo	300 11.5 Br	299 7.6 Ah	305 13.9 Br	**RZ Cyg**	298 11.9 Br
314 9.0 Jo	300 11.2 O	299 7.9 Wd	311 13.3 Ch	204846	307 12.0 Br
R Tel	303 11.8 El	300 7.4 Jo	333[13.6 Ma	298 10.7 Br	**RS Aqr**
200747	303 11.4 Pt	301 7.7 Hf	**S Del**	303 10.7 Pt	*210504*
297 12.4 En	308 12.0 El	302 7.8 So	203816	**S Ind**	303 13.3 Pt
RU Aql	309 12.0 Cy	303 7.7 GD	244 9.8 Hu	*204954*	309 12.8 Cy
200812	310 11.7 Ko	303 7.2 Pt	244 9.8 Ar	297 13.2 Ht	**Z Cap**
274 13.5 Ma	328 12.0 Wd	306 7.6 Ah	300 9.0 Jo	302 12.6 Ht	*210516*
306 11.7 L	336 8.9 Mc	306 7.8 Wd	303 9.0 Pt	307 12.8 Ht	303 9.1 Pt
310 10.8 Ma	**SX Cyg**	308 7.7 GD	306 9.1 Ah	311 13.1 En	314 9.0 Ch
333 9.7 Ma	201130	310 7.9 Wd	307 8.9 Th	**X Del**	**R Equ**
W Cap	282 9.6 Cy	310 7.5 Ra	309 8.9 Th	205017	210812
200822	282 9.1 Ch	311 7.6 Jo	309 8.8 Cy	244 11.0 Hu	272 11.2 Cy
303[12.5 Pt	303 10.3 Pt	312 8.0 Hv	311 9.1 Ch	244 11.5 Ar	277 11.7 Ma
Z Aql	309 11.5 Cy	313 7.7 GD	311 9.0 Th	249 11.7 Ar	300 10.4 Br
200906	**RT Sgr**	314 7.7 Ah	313 9.0 Th	249 11.5 Hu	303 10.0 Pt
303 10.0 Pt	*201139*	314 7.7 Jo	314 8.9 Ah	257 11.8 Ar	306 10.3 L
R Sge	297 12.7 En	315 7.8 Ah	**V Cyg**	294 13.6 Br	309 10.4 Cy
200916	**WX Cyg**	315 7.9 Hf	203847	305 14.0 Br	333 11.4 Ma
238 8.4 Me	201437b	315 8.0 Wd	274 12.6 Ma	309 13.2 L	**T Cep**
249 8.8 Me	282 11.0 Cy	320 7.5 Sx	282 12.3 Ch	311 13.8 Ch	210868
300 9.5 Jo	282 10.8 Ch	322 7.5 Sx	294 12.8 Br	**UX Cyg**	212 8.2 Ch
301 9.5 An	299 10.5 Wd	324 7.6 Sx	303 13.4 Pt	205030a	243 9.3 Ch
310 8.6 An	300 10.5 Jo	325 7.5 Ra	306 13.2 L	305 14.7 Br	265 9.6 Ch
311 8.8 Jo	302 10.9 Wd	325 8.0 So	307 13.1 Br	**RR Cap**	280 10.0 Fd
314 8.6 Jo	303 10.0 Pt	328 7.9 Wd	333 13.8 Ma	*205627*	292 10.4 Ch
322 8.7 Me	306 11.3 Cy	328 7.8 Hv	**Y Aqr**	311[13.4 En	294 10.7 Ah
RS Cyg	306 11.1 L	333 8.5 Mc	*203905*	**R Vul**	295 10.7 Mn
200938	307 10.2 Jo	336 8.6 Mc	303[12.3 Pt	205923a	299 10.6 Ah
208 7.3 Ch	310 11.1 Wd	**U Mic**	314[13.3 Ch	290 7.6 Ah	300 10.1 Jo
237 8.2 Ch	311 9.8 Jo	*202240*	**T Del**	294 7.9 Ah	300 10.6 Wd
249 7.7 Me	314 9.4 Jo	297 13.0 En	204016	298 8.4 Ah	300 10.2 Hv
275 8.0 Cy	314 11.3 Cy		280[11.5 Fd	299 8.5 Ah	302 10.7 Mn

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1933.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T CEP	W CYG	U PSA	RV PEG	R PEG	ST AND
210868	213244	*215628*	222129	230110	233335
303 10.8 El	336 6.3 Mc	300[13.0 En	307 12.8 Br	314 7.7 O	314 10.9 Al
303 10.2 Pt	337 6.4 Mc	U AQR	309 13.5 L	315 7.3 Ah	327 11.4 Al
304 9.8 Ra	339 6.4 Mc	*215717*	S LAC	V CAS	R AQR
305 10.1 Sq	S CEP	303 12.5 Pt	222439	230759	*233815*
306 10.8 Ah	213678	S PSA	297 8.0 Th	303 11.6 El	277 6.7 Ma
307 9.8 Jo	208 8.8 Ch	*215828*	298 7.9 Th	303 11.5 Pt	295 6.7 Ch
310 10.7 Wd	290 9.4 Mi	300[13.0 En	303 8.0 El	306 11.9 Cy	297 6.9 Ht
310 11.0 Ko	299 9.5 Sq	RT PEG	303 8.0 Pt	308 11.5 El	300 7.2 Jo
314 10.3 Hf	300 9.1 Jo	215934	305 8.2 Th	311 10.0 Hv	303 6.9 Ht
314 10.2 Hv	303 9.0 Pt	277 11.0 Ma	307 8.1 Th	314 11.4 Cy	303 7.2 Pt
314 10.5 Wd	305 9.5 Sq	300 10.8 Br	308 7.4 El	W PEG	307 7.3 Jo
314 10.7 Mn	307 9.5 Jo	303 10.4 An	309 8.3 Ko	231425	307 6.6 Bc
314 10.2 Sh	310 10.4 Cy	309 10.8 L	309 8.4 L	244 9.3 Hu	307 6.9 Ht
314 9.6 Jo	311 9.8 Jo	333 13.1 Ma	310 8.0 Cy	244 9.4 Ar	309 6.8 Hf
314 10.9 Ah	314 10.1 Sh	RY PEG	311 8.2 Th	300 10.8 Jo	310 6.3 Cy
320 10.0 Sq	314 10.2 Wd	220133a	313 8.2 Th	307 11.0 Jo	310 6.7 An
328 10.1 Wd	318 8.8 Ra	303 11.8 Pt	314 7.8 Jo	310 10.5 Cy	311 7.0 Jo
336 8.6 Mc	326 10.1 Sq	RZ PEG	314 8.1 Hf	310 11.9 L	312 6.8 Hf
337 8.8 Mc	337 10.2 Mc	220133b	328 8.6 Hf	S PEG	314 7.0 Hf
RR AQR	RU CYG	274 10.9 Cy	R IND	231508	314 7.0 Bc
210903	213753	303 10.1 Pt	*222867*	303 11.0 Pt	315 6.9 Ht
303 9.5 Pt	294 9.0 Ah	309 9.9 L	297 9.3 Ht	305 10.7 Br	315 7.5 L
Y PAV	295 9.2 Ry	310 10.4 Cy	300 8.9 En	310 10.5 Cy	327 7.3 Sq
211570	299 8.9 Ah	T PEG	302 9.1 Ht	310 10.3 L	333 7.3 Ma
297 5.6 Ht	301 8.9 Jo	220412	307 9.3 Ht	V PHE	Z CAS
302 5.7 Ht	303 8.8 Pt	244 10.6 Cy	315 9.4 Ht	*232746*	233956
307 5.7 Ht	305 9.3 Ry	276 12.2 Gy	T TUC	297[13.2 Ht	297[14.4 Br
315 5.6 Ht	307 8.7 Jo	297 13.4 Br	*223462*	300 13.2 En	310 14.6 L
X PEG	310 8.8 Cy	305 14.0 Br	297[13.3 Ht	307[13.2 Ht	TX CEP
211614	311 8.5 Jo	309 13.9 L	300 13.3 En	Z AND	234875
277 13.9 Ma	311 9.3 Ry	Y PEG	R LAC	232848	294 12.6 Br
301 11.5 Jo	314 8.7 Ah	220613	223841	273 10.7 Cy	305 12.8 Br
303 12.0 Pt	333 8.2 Mc	303 11.1 Pt	297 14.5 Br	277 10.6 Cy	RR CAS
306 11.8 L	337 8.4 Mc	RS PEG	307 14.6 Br	277 10.7 Ma	235053
312 11.2 Jo	RV CYG	220714	S AQR	282 10.5 Cy	293 11.6 Bn
333 11.1 Ma	213937	297 13.8 Br	*225120*	284 10.7 Cy	297 11.8 Br
T CAP	303 6.7 Pt	303 13.2 Pt	301 11.6 En	301 10.9 Pk	305 11.3 Bn
211615	RR PEG	305 13.8 Br	RW PEG	303 10.4 Pt	311 11.3 Bn
314[12.8 Ch	214024	309 13.2 L	225914	306 10.7 Cy	315 11.3 Bn
S MIC	277 12.9 Ma	R PSA	277 13.0 Ma	310 10.7 Cy	V CET
212030	296 10.6 Br	*221230*	297 10.5 Br	311 11.1 Ko	*235209*
296 8.4 Bh	301 11.0 Jo	300 11.6 En	303 10.3 Pt	314 10.6 Cy	315 10.0 L
300 8.5 En	303 10.4 An	X AQR	310 9.7 L	314 10.1 Jo	R TUC
307 8.6 En	303 10.2 Pt	*221321*	333 9.7 Ma	322 10.8 Ma	*235265*
Y CAP	310 9.9 Cy	300[13.4 En	R PEG	327 10.9 Me	297[13.5 Ht
212814	314 9.0 O	T GRU	230110	333 10.3 Ma	300[12.9 En
314[12.5 Ch	314 9.1 Ch	*221938*	290 8.4 Ah	ST AND	307[13.5 Ht
W CYG	333 8.5 Ma	300 8.6 En	294 8.2 Ah	233335	311[12.9 En
213244	R GRU	S GRU	298 8.1 Ah	266 10.6 Cy	R CAS
299 5.9 An	*214247*	*221948*	299 7.9 Ah	274 10.8 Cy	235350
301 6.0 An	307 12.9 En	300 13.4 En	300 7.6 Jo	284 11.2 Cy	290 7.6 Ah
303 6.0 An	307 13.0 Ht	302 13.0 Ht	303 7.6 Pt	300 11.6 O	294 7.7 Ah
304 5.9 An	314 12.4 En	307 12.9 Ht	306 7.5 Ah	300 10.7 Jo	294 7.7 Ch
305 5.9 An	V PEG	307 12.8 En	309 7.6 Hf	303 11.3 Pt	295 7.9 Mn
306 5.8 L	215605	314 12.2 En	309 7.6 Sf	306 11.4 Cy	296 7.8 Ra
308 5.9 An	301 9.8 Jo	RV PEG	312 7.1 Jo	311 10.6 Jo	299 7.8 Wd
309 5.9 An	303 10.0 Pt	222129	312 7.4 Ah	314 10.8 Jo	299 7.6 Sh
333 6.2 Mc	306 10.1 L	297 12.8 Br	314 7.6 Hf	314 11.5 Cy	300 7.6 Jo

Variable Star Observations Received During September, 1933.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

R Cas 235350		R Cas 235350		R Cas 235350		Z Peg 235525		W Cet *235715*		SV And 235939	
302	7.9 Hf	314	8.5 Wd	328	8.8 Wd	303	12.3 Pt	310	9.0 An	277	13.1 Cy
302	7.6 Wd	314	8.2 Mn	Z Peg 235525		310	12.2 L	311	8.9 Cy	298	13.0 Br
302	8.0 Mn	314	8.5 Sh			*326*	11.5 Gy	Y Cas 235855		303	12.7 Pt
307	7.5 Jo	314	7.8 Jo	244[	11.6 Gy	W Cet *235715*				306	12.7 Cy
310	8.0 Wd	315	8.2 Ah	276[	11.6 Gy			300	11.9 Br	314	12.6 Cy
311	7.6 Jo	316	8.5 Hf	298	12.1 Br	309	9.0 Hf	300	10.6 Jo	333	10.9 Ma
313	8.2 Ah							310	12.1 L		

Rapidly Varying Irregular Variables.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
005840 RX Andromedae—					081473 Z Camelopardalis—				
	7249.7	11.3 Me	7304.8	12.7 Pt		7268.6	12.0 Gy	7307.7	11.8 Pt
	7246.7[	12.7 Gy	7305.5	13.2 Ry		7282.7	10.7 Cy	7308.5	12.2 Ry
	7276.7[	12.5 Gy	7305.8	13.6 Br		7283.6	11.2 Cy	7308.6	11.9 Ar
	7286.5	12.9 Ry	7305.8	12.8 Pt		7286.5	11.7 Ry	7308.7	11.7 Pt
	7288.6	13.1 Ry	7306.5	13.1 Ry		7297.5	13.1 Ry	7309.5	12.3 Ry
	7290.5[	11.8 Ry	7307.7	13.0 Pt		7297.6	11.2 Cy	7309.6	12.0 Cy
	7291.4[	11.8 Ry	7307.8	13.0 Br		7298.8	12.3 Pt	7309.6	12.2 L
	7292.5[	11.8 Ry	7308.5	13.0 Ry		7299.7	12.7 Pt	7309.8	12.1 Pt
	7294.5[	12.5 Ry	7308.7	12.8 Pt		7300.7	10.9 Pt	7310.5	12.2 Ry
	7295.5	11.7 Ry	7309.5	11.1 Ry		7301.5	10.8 Ry	7310.6	11.9 Ko
	7297.5	11.1 Ry	7309.7	10.8 Cy		7301.7	10.8 Pt	7310.6	12.0 Cy
	7297.6	10.5 Cy	7309.8	11.4 Pt		7302.6	10.8 Ko	7311.5	11.8 Ry
	7297.8	11.0 Br	7310.5	11.1 Ry		7303.7	11.4 Pt	7311.6	11.7 El
	7298.5	11.2 Ry	7310.7	11.4 Ko		7304.6	11.2 Cy	7311.6	11.8 Ar
	7298.8	11.2 Br	7311.5	11.6 Ry		7304.6	11.4 Ar	7312.5	11.7 Ry
	7298.8	11.5 Pt	7312.5	11.8 Ry		7304.8	11.7 Pt	7312.7	11.5 Pt
	7299.7	11.5 Pt	7312.7	11.8 Pt		7305.5	11.3 Ry	7313.6	11.5 Ar
	7300.7	11.9 Pt	7322.6	11.3 Me		7305.7	11.5 Ar	7314.7	11.4 Ar
	7300.8	11.6 Br	7324.7	11.6 Pt		7305.8	11.5 Pt	7315.6	11.3 El
	7301.5	12.7 Ry	7325.6	11.6 Me		7306.5	11.7 Ry	7321.6	12.3 Me
	7301.7	12.7 Pt	7327.6	12.4 Gy		7306.6	12.1 Cy	7322.6	12.2 Me
	7303.7	13.2 Pt	7327.7	12.1 Me		7306.6	11.6 L	7324.7	12.8 Pt
060547 SS Aurigae—						7306.7	11.4 Ar	7325.6	12.8 Me
	7115.6[	12.6 Mi	7305.5[	13.2 Ry		7306.7	11.8 Pt	7325.8	12.8 Pt
	7154.6	13.4 Mi	7306.0[	14.5 Br		7307.6	11.4 El	7327.7	**12.9 Me**
	7206.1[	13.2 Ch	7307.9[	12.6 Pt	*174406* RS Ophiuchi—				
	7213.1[	13.2 Ch	7308.9	14.9 El		7300.7	6.4 Pt	7307.6	7.4 Mg
	7276.8[	11.5 Gy	7309.6[	13.3 L		7301.7	6.3 Pt	7307.7	7.4 Br
	7286.5[	11.5 Ry	7310.6[	13.9 L		7302.7	**6.6 Pt**	7307.7	7.1 Pt
	7288.6[	11.5 Ry	7310.8[	12.5 Cy		7303.5	6.5 Ry	7308.6	7.2 El
	7294.5[	11.5 Ry	7311.6[	14.3 L		7303.6	6.9 Hf	7308.6	7.5 Mg
	7295.5[	12.5 Ry	7312.5[	13.2 Ry		7303.6	6.8 Sf	7308.7	7.6 Br
	7297.5[	12.5 Ry	7315.6[	14.5 L		7303.7	6.9 Pt	7308.7	7.0 Pt
	7298.5[	11.5 Ry	7316.6[	14.5 L		7304.8	7.1 Pt	7309.4	7.6 Ry
	7301.5[	**12.5 Ry**	7319	13.3 L		7305.5	7.2 Ry	7309.6	7.7 Wd
	7303.9[	13.2 El	7325.8	11.0 Pt		7305.7	6.9 Bf	7309.6	7.2 El
	7304.8[	12.5 Pt				7305.7	6.9 Bc	7309.6	7.5 Sf
074922 U Geminorum—						7305.8	7.1 Pt	7309.6	7.6 Mg
	7115.6[	12.6 Mi	7211.1[	13.7 Ch		7306.4	7.5 Ry	7309.7	7.5 Br
	7154.7	14.6 Mi	7308.9[	12.4 Pt		7306.6	7.0 El	7309.7	7.6 Wa
	7204.1	13.9 Ch	7333.9	13.9 Ma		7306.6	7.3 Mg	7309.7	7.7 Ko
081473 Z Camelopardalis—						7306.7	6.9 Pt	7310.3	7.5 Be
	7133.7	12.6 Mi	7246.7	11.8 Gy		7306.7	7.2 Br	7310.4	7.4 L
	7175.6	12.6 Mi	7249.8	12.7 Ar		7307.7	7.1 Bc	7310.6	7.7 Wd
	7213.1	12.4 Ch	7257.8	12.2 Ar		7307.6	7.6 Jo	7310.6	**7.8 Ko**
	7244.7	11.2 Gy	7263.6	10.8 Gy		7307.6	7.1 El	7310.6	7.6 Wa

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1933.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
174406 RS	OPHIUCHI—						213843 SS	CYGNI—					
	7310.6	7.5	Sf	7318.6	8.2	Wd		7238.7	8.8	Pt	7299.7	11.7	Pt
	7310.6	7.7	Mg	7318.6	7.7	Al		7243.7	11.6	Ar	7299.8	10.9	Bh
	7310.7	7.6	Br	7318.7	8.3	Ra		7243.7	11.5	Hu	7299.8	10.6	Hv
	7310.7	7.7	Ma	7320.6	8.1	Wh		7244.7	11.5	Ar	7300.5	11.7	Ma
	7310.7	7.4	Pt	7320.6	8.1	Cu		7244.7	11.5	Hu	7300.6	11.7	Mg
	7311.6	7.8	Jo	7320.7	8.4	Hi		7247.7	11.9	Ma	7300.6	11.9	Jo
	7311.6	7.5	El	7321.5	8.3	C		7248.0	11.6	Hr	7300.6	11.1	O
	7311.6	7.6	O	7321.6	8.4	C		7249.7	12.0	Hu	7300.6	11.1	Wd
	7312.6	7.9	Jo	7321.6	8.4	Wd		7249.7	12.0	Ar	7300.7	11.9	El
	7312.6	7.8	Wd	7321.7	8.2	Pt		7249.7	11.8	Pt	7300.7	11.0	Br
	7312.6	7.5	O	7321.7	8.6	Hi		7250.7	12.0	Ar	7300.7	11.7	Pt
	7312.7	7.8	Pt	7322.7	8.7	Wa		7254.0	11.8	Hr	7300.9	11.0	Br
	7313.3	7.7	Th	7323.6	8.6	Wa		7257.2	11.8	Hr	7301.5	11.9	Pk
	7313.7	7.8	Pt	7323.7	8.5	Ra		7257.8	12.0	Ma	7301.6	11.9	Jo
	7314.3	7.6	Th	7323.7	8.4	Pt		7257.8	12.0	Ar	7301.6	11.2	Mg
	7314.6	7.8	Wd	7324.6	8.6	Cp		7260.8	12.1	Ma	7301.7	11.6	Pt
	7314.6	7.8	Cu	7324.7	8.4	Pt		7263.7	11.9	Ma	7301.7	10.8	Br
	7314.6	7.8	Wh	7325.6	8.4	Hf		7265.7	11.9	Ma	7301.8	10.9	Bh
	7314.6	7.7	El	7325.6	8.6	Wd		7269.8	12.1	Ar	7302.6	10.9	O
	7314.6	7.6	Sh	7325.6	9.1	C		7271.9	11.9	Ma	7302.6	11.5	Wd
	7314.6	7.9	Jo	7325.6	8.4	Me		7272.8	12.0	Ma	7302.6	11.6	Ko
	7314.6	7.9	Bc	7326.5	9.2	C		7273.8	12.0	Ma	7302.6	11.3	Mg
	7314.7	7.9	Pt	7326.6	8.6	Hf		7274.7	11.8	Ma	7302.7	11.7	Pt
	7315.3	8.2	Be	7326.6	8.8	Wd		7275.8	11.9	Md	7302.7	11.5	Gw
	7315.4	8.2	L	7326.6	8.8	Gy		7276.8	11.5	Ma	7302.7	11.4	Ar
	7315.5	8.0	C	7326.6	8.4	Al		7277.7	12.0	Ma	7302.7	11.3	Br
	7315.5	8.1	Wh	7327.5	9.3	C		7280.7	11.9	Fd	7302.8	11.4	Hu
	7315.6	8.0	Jo	7327.5	9.1	Cp		7282.2	12.0	Ch	7303.3	10.1	An
	7315.6	7.8	Hf	7327.6	8.7	Me		7286.5	11.9	Pk	7303.6	10.1	Sf
	7315.6	7.8	Wd	7327.6	8.5	Al		7286.5	11.7	Ma	7303.6	10.4	Ar
	7315.6	7.7	El	7328.5	9.4	C		7287.6	11.9	Pk	7303.7	10.3	Pt
	7315.6	7.9	Al	7328.6	8.7	Wd		7290.8	11.8	Ma	7303.7	10.1	El
	7316.3	7.9	Th	7328.6	8.6	Hf		7291.5	11.9	Pk	7303.8	9.8	Ar
	7316.6	7.9	El	7328.6	8.7	Sf		7291.8	11.9	Ma	7304.3	9.4	An
	7316.6	8.3	Bc	7329.5	9.5	C		7292.7	11.4	Ma	7304.6	9.4	Cy
	7316.7	8.0	Br	7333.6	8.7	Ma		7292.7	11.9	Br	7304.6	9.6	Ar
	7316.7	8.4	Pt	7334.6	9.4	C		7292.7	11.7	Cy	7304.6	9.7	Gw
	7317.7	8.1	Pt	7338.6	9.6	C		7292.8	11.9	Bh	7304.8	9.2	Pt
	7318.5	8.4	C	7344.5	9.8	C		7293.7	11.9	Br	7305.3	9.1	An
	7318.6	8.1	Hf	7345.5	9.8	C		7294.4	11.4	Ah	7305.4	9.2	Ah
202946 SZ	CYGNI—							7294.5	11.8	Pk	7305.6	9.5	Bc
	7298.8	9.7	Pt	7309.8	9.0	Pt		7294.7	11.5	Br	7305.6	9.4	Ar
	7299.7	9.6	Pt	7310.7	9.5	Pt		7295.8	11.2	Bh	7305.7	9.1	Br
	7300.7	9.7	Pt	7312.7	9.6	Pt		7296.5	11.6	Pk	7305.7	9.4	Ar
	7301.7	9.6	Pt	7313.7	9.6	Pt		7296.7	11.5	Br	7305.8	9.2	Pt
	7302.7	9.5	Pt	7314.7	9.6	Pt		7296.8	11.1	Bh	7306.3	9.0	Be
	7303.7	9.1	Pt	7316.7	9.5	Pt		7297.5	12.0	Pk	7306.3	8.9	L
	7304.8	8.8	Pt	7317.7	9.6	Pt		7297.6	11.2	Cy	7306.3	9.0	An
	7305.8	8.9	Pt	7321.7	8.7	Pt		7297.7	11.5	Br	7306.4	8.7	Ah
	7306.7	8.9	Pt	7323.7	9.1	Pt		7297.8	11.2	Bh	7306.5	9.1	Pk
	7307.7	9.0	Pt	7324.7	9.3	Pt		7297.9	11.6	Ma	7306.6	8.3	Cy
	7308.7	8.9	Pt	7325.8	9.4	Pt		7298.4	11.5	Ah	7306.6	9.0	El
213843 SS	CYGNI—							7298.6	11.8	Bc	7306.6	9.1	Gw
	7212.1	10.9	Hr	7233.0	8.2	Hr		7298.7	11.6	Br	7306.6	9.1	Ar
	7220.1	11.5	Hr	7234.0	8.2	Hr		7298.8	11.6	Pt	7306.7	9.0	Mg
	7221.7	11.9	Ma	7235.0	8.4	Hr		7299.4	11.3	Ah	7306.7	9.2	Pt
	7226.8	8.4	Ma	7235.2	8.3	Ch		7299.6	10.9	Cy	7306.8	8.8	Br
	7228.1	8.0	Hr	7235.7	8.2	Pt		7299.6	10.9	Sh	7306.8	8.6	Bh
	7231.6	8.5	So	7237.8	9.2	Ma		7299.6	11.0	Wd	7307.3	8.4	An

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1933.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
213843 SS CYGNI—					213843 SS CYGNI—				
	7307.5	8.8 Pk	7309.8	9.1 Wa		7312.7	10.1 Hf	7317.7	11.7 Pt
	7307.6	8.6 El	7309.8	9.1 Pt		7312.7	10.4 Pt	7317.7	11.9 Ma
	7307.6	8.4 Ar	7310.4	9.1 An		7313.3	10.2 An	7317.7	11.9 Wa
	7307.6	9.0 Bc	7310.6	9.5 Rb		7313.4	10.3 Ah	7318.6	12.0 Hf
	7307.6	9.4 Bf	7310.6	8.6 Cy		7313.6	10.2 Ar	7318.6	11.9 Wd
	7307.7	9.2 Pt	7310.6	9.1 Wd		7313.7	10.4 Pt	7321.6	11.8 Pt
	7307.7	8.7 Br	7310.6	9.5 Ko		7314.4	10.9 Ah	7321.6	12.1 Ar
	7307.7	8.3 Ar	7310.6	9.0 Sf		7314.6	11.6 Jo	7321.7	11.7 Pt
	7307.7	8.4 Gw	7310.6	9.0 Ar		7314.6	11.0 Bc	7321 8	11.9 Ma
	7308.3	8.4 An	7310.7	9.1 Ar		7314.6	11.0 Cy	7322.6	11.9 Me
	7308.5	8.7 Pk	7310.7	9.3 Br		7314.6	11.0 El	7322.6	11.9 Wa
	7308.6	8.6 Ar	7310.7	9.2 Hf		7314.6	10.9 O	7323.7	12.0 Ar
	7308.7	9.1 Pt	7310.7	9.3 Pt		7314.6	11.2 Sh	7323.7	11.7 Pt
	7308.7	8.6 Br	7310.8	9.4 Ma		7314.6	11.1 Wd	7324.7	11.7 Pt
	7308.7	8.5 El	7311.1	9.5 Ch		7314.7	11.5 Wa	7324.8	11.9 Ma
	7308.7	8.6 Ar	7311.3	9.3 An		7314.7	10.9 Ar	7325.6	11.8 So
	7308.7	9.5 GD	7311.6	10.0 Jo		7314.7	11.0 Pt	7325.6	12.0 Me
	7309.3	8.5 An	7311.6	9.4 Cy		7314.7	10.7 Hf	7325.6	12.1 Ar
	7309.5	8.8 Pk	7311.6	9.8 O		7314.8	11.2 Ma	7325.8	11.7 Pt
	7309.6	8.7 Wd	7311.6	9.8 Ko		7315.4	11.4 Ah	7326.6	11.7 Hf
	7309.6	8.3 Cy	7311.6	9.5 Ar		7315.6	11.9 Jo	7326.6	11.9 Wd
	7309.6	8.8 El	7311.7	9.5 El		7315.6	10.7 L	7326.6	12.1 Gw
	7309.6	8.9 L	7312.3	9.5 An		7316.6	11.9 El	7327.6	12.1 Ar
	7309.6	8.5 Sf	7312.4	9.7 Ah		7316.6	11.6 L	7327.7	12.1 Me
	7309.7	8.8 Br	7312.5	9.7 Pk		7316.7	11.3 Ra	7327.7	12.0 Hu
	7309.7	8.4 Ko	7312.6	9.9 Jo		7316.7	11.6 Br	7328.6	12.0 Wd
	7309.8	9.2 Ma	7312.6	9.8 O		7316.7	11.7 Pt	7333.8	11.9 Ma

SUMMARY FOR SEPTEMBER, 1933.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	40	174	Houston	Hu	16	39
Allen, P. R.	Al	12	17	Hunt	Hv	21	30
Ancarani	An	28	64	Hurahata	Hr	7	45
Armfield	Ar	14	95	Jones	Jo	96	292
Ballhaussen	Ba	2	5	Kohman	Ko	21	35
Benini	Be	17	26	Lacchini	L	86	102
Brocchi	Br	85	134	Loreta	Lr	4	5
Brown, A. N.	Bn	3	14	Marsh	Ma	43	130
Buckstaff,E.F.	Bf	3	4	McLeod	Mc	23	70
Buckstaff,R.N.	Bc	6	28	Meek	Me	37	80
Bunch	Bh	11	30	Mennella	Mn	14	35
Campbell	C	1	13	Millard	Md	11	11
Cap	Cp	1	2	Miller	Mi	14	17
Chandra	Ch	135	235	Monnig	Mg	10	19
Cilley	Cy	63	163	Olcott	O	27	34
Cunningham	Cu	1	2	Parthe	Pa	4	7
Eliason	El	74	128	Peltier	Pt	192	358
Ensor	En	84	155	Perkinson	Pk	7	20
Ford	Fd	19	22	Preucil	Pf	2	6
Godfrey Club	GD	4	11	Raphael	Ra	31	75
Goodsell	Gs	4	4	Reynolds	Rl	4	4
Grandstaff	Gr	10	10	Rosebrugh	Rb	4	5
Gregory	Gy	33	89	Recinsky	Rc	8	12
Grunwald	Gw	4	17	de Roy	Ry	7	45
Hartmann	Hf	54	119	Ruben	Ru	2	21
Hildom, A.	Hi	9	11	Scanlon	So	12	20
Houghton	Ht	78	230	Schenkman	Se	5	18

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Salanave	Sx	3	11	Theile	Th	7	35
Shinkfield	Sl	20	20	Watson	Wa	2	8
Shultz	Sz	14	20	Webb	Wd	41	131
Smith, L.	Sh	16	20	Whipple	Wh	1	3
Smith, F. P.	Sq	14	30				
Smith, F. W.	Sf	9	19	Totals		64	400	3634

LEON CAMPBELL, *Recorder.*

October 12, 1933.

Meteor Notes from the American Meteor Society

By CHARLES P. OLIVIER, President

The data submitted on the Perseids were so extensive that it was necessary to print Table II in this issue. In addition, we give several other observation which came in too late for inclusion last month. Even yet we have had no reports from several of our distant members who are believed to have done considerable work at the Perseid epoch. However, there is no probability that they would appreciably alter the general conclusions as to numbers per hour given in the October Notes.

TABLE II.

Observer and Station	1933 Aug.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
(*1) Armfield, L., Milwaukee Astronomical Society, observing 25 miles S of Milwaukee, Wis.	11	10:30	15:30	300	21		4.2	
(*1, 2) Armfield, Mrs. L. (same)	11	9:30	13:15	225	142		37.8	
(*1, 2) Hady (same)	11	13:15	15:30	135	122		54.2	
(*1, 2) Haertel, R., Milwaukee, Wis.	11	8:00	12:30	270	77		17.1	
(*1, 3) Steven, C. C., Milwaukee	11	10:10	14:00	230	121		31.6	
(*1, 2) Thompson, T., Milwaukee	11	8:00	12:30	270	79		17.5	
(*1, 2, 4) Boyd, A., 25 miles N of Milwaukee, Wis.	11	11:25	12:55	90	59		39.3	
(*1, 2, 4) Fotch, A., (same)	11	11:25	12:55	90	58		38.7	
(*1, 5) Cooke, B. D., Wauwatosa, Wis.	11	10:30	12:00	90	18		12.0	
Blair, Mrs. J. H., East Point, Ga.	10	12:30	14:45	135	27		12.0	
	11	12:30	14:00	90	5	0.1	3.3	
	12	9:15	14:30	315	13	0.5	2.5	
Butler, R. B., Plainfield, N. J.	July 28	12:00	15:00	180	12	0.8	4.0	5.0
(*6) Buttles, L. I., Chicago, Ill.	11	10:15	12:08	113	41		..	
(*7)	13	16:15	17:12	57	6		6.3	
(*8) Graham, J. W., Salem, Ore.	10	12:00	13:00	60	13		13.0	
(*8, 9)	11	12:00	16:00	240	158		39.5	
(*8) Persons, W. J., Kalamazoo,	11	10:00	11:00	60	50		50.0	
(*18) Michigan	11	10:00	11:00	60	46		46.0	
(*19)	11	11:50	12:50	60	34		34.0	
(*20) Preucil, F., Joliet, Ill.	11	9:15	10:15	60	31		31.0	
					37		37.0	
					34		34.0	
					35		35.0	
(*8)	11	12:00	14:00	120	136		68.0	
Schenkman, A., New Brunswick, New Jersey	14	8:55	9:52	57	4	1.0	4.2	4.2
	15	12:40	14:28	108	9	1.0	5.0	5.0
Smith, F. W., Glenolden, Pa.	12	10:00	11:45	105	2		1.1	
	14	9:45	11:45	120	9	1.0	4.5	4.5

WEBSTER GROVES OBSERVERS.

Observer and Station	1933 Aug.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
(*8) O'Byrne, S. L., Allenton, Mo.....	11	11:38	12:46	68	100		88.5	
(*21)		14:13	15:25	72	34		28.3	
(*8) Beerman, Miss, Kirkwood, Mo...	11	13:15	14:15	60	38		38.0	
(*8) Gallagher, Miss J., ...	11	9:00	10:00	60	26		26.0	
(*8) Kirkwood, Mo.		13:15	14:15	60	18		18.0	
(*8, 22) Jones, S. P., Web. Groves....	11	11:15	12:00	45	15		20.0	
(*8) Menke, B. A., ...	11	8:35	9:35	60	28		28.0	
(*8) Webster Groves, Mo.		11:29	12:29	60	38		38.0	
(*2) Harbutt, R.G., Canandaigua, N.Y..	11	11:00	13:30	150	17		6.8	
Jones, W., Bristol, Tenn.	11	10:00	11:00	60	23	1.0	23.0	23.0
	12	9:20	10:20	60	10	1.0	10.0	10.0
Kenney, W. G., Freeport, N. Y.	14	10:30	13:00	150	17		6.8	
	15	11:00	17:30	390	36		5.9	
(*8) Kingsbury, J.A., Ulster Co., N.Y..	12	12:00	14:00	120	36		18.0	
(*8) Kingsbury, Mrs., Ulster Co., N.Y..	12	12:00	13:00	60	8		8.0	
Kirkpatrick, G. P., ...July	28	12:08	14:52	164	16	0.9	5.9	6.6
Piermont, N. Y.	29	12:11	13:11	60	9	0.7	9.0	12.9
Aug.	11	12:20	15:10	170	29		10.2	
(*10) Kusner, J. H., ...July	27	12:00	14:00	120	25		12.5	
(*11) Gainesville, Fla. Aug.	10	12:00	14:00	120	15		7.5	
(*12)	11	10:20	13:00	160	81		30.4	
(*13)	12	11:00	13:00	120	11		5.5	
(*14)	12	11:00	13:15	135	26		11.5	
	14	12:00	12:30	30	2		..	
(*15) Molyneaux, D., Binghamton, N.Y.	12	13:00	15:30	150	81		32.4	
(*16) Naval Observatory, Washington, D. C. (by M. Sharnoff).....	12	12:37	15:53	151	23		..	
(*17) Olivier, C. P., Ulster Co., N.Y..	12	11:00	14:00	180	36	0.7	12.0	17.1
(*8) Schench, J. G., Web. Groves	11	8:35	12:45	180	88		29.3	
(*8) Schnaedelbach, Miss I., Allenton, Mo.	11	10:31	12:43	120	111		55.5	
(*8) Stoecker, W. C., Web. Groves..	11	9:00	16:00	420	157		22.4	
(*22, 8) Stones, Mrs. H., Web. Gr. ..	11	9:50	10:50	60	23		23.0	
(*22, 8) Stones, V., Web. Groves.....	11	14:45	15:45	60	50		50.0	

REMARKS.

(1) Milwaukee Astronomical Society observer. (2) Perseids only: count. (3) 28 plotted in first hour; remainder counted in subsequent time. (4) Entirely cloudy at end. (5) 2 plotted. "Cloudy." (6) Three observers, not all observing constantly. Count, notes on each. (7) View to SW obstructed. (8) Count. (9) Dawn began about 15:40. (10) 4 Perseids, 9 Delta Aquarids. (11) Seven plotted. (12) 55 plotted; two assistants. (13) NE only; 6 plotted. (14) SE only; 11 plotted. Observations by E. McVoy. (15) Count; 76 Perseids. (16) Occasional haze and fog. (17) 20 plotted. (18) Count by Mrs. H. E. Persons. (19) Count by Prof. J. Hill. (20) These four are count in the quadrants NE, NW, SW, and SE respectively. (21) 29 Perseids. (22) Restricted view.

ADDITIONAL PERSEID REPORTS.

Observer and Station	1933 Aug.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
(*1) Baines, Wm., Okanogan, Wash...	10	9:00	10.30	90	21		14.0	
(*2)	11	8:30	10:00	90	31		20.7	
(*3)	12	9:00	10.00	60	12		12.0	
(*4) Urquhart, Miss S., ...	1	13:33	15:42	129	33	1.0	15.3	15.3
(*4) Fay Lake, Mich.	10	10:58	13:30	152	20		7.9	
(*4)	11	10:37	15:14	199	86		25.9	
(*4)	13	10:30	11:53	83	21	0.9	15.2	16.9
(*4, 5)	18	11:24	11:56	32	7		13.1	
(*6) Campbell, Frank B., Denver, Colo.	11	11:32	12:06	34	25		...	

Observer and Station	1933	Aug.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
(*7) Dyott, G., Eugene, Oregon		11	9:30	11:00	90	44		29.3	
(*8) Rudeberg, W. P., Niles Center, Ill.		11	11:10	12:10	60	35		35.0	
(*9) Toerring, H., Philadelphia, Pa.		2	14:00	15:10	70	10		...	
Simpson, J. W., Los Angeles, Calif.	July	23	14:20	15:20	60	5	0.7	5.0	7.1
		24	10:55	11:55	60	6	0.7	6.0	8.6
		25	11:30	12:30	60	5	0.7	5.0	7.1
Red Box Canyon, Calif.		26	10:00	15:45	270	133	0.8	29.6	37.0
Mt. Wilson, Obs., Calif.		27	8:50	15:15	120	57	0.5	28.5	...
		28	10:30	15:40	260	149	0.8	34.4	43.0
Los Angeles, Calif.	Aug.	8	14:25	14:55	30	9	0.7	18.0	25.7
		10	11:07	14:50	180	74	0.6	24.7	41.2
Mt. Wilson Obs., Calif.		11	10:50	16:05	265	209	0.7	47.3	67.6
Los Angeles, Calif.		15	14:35	15:35	60	19	0.7	19.0	27.1
		16	13:00	14:00	60	23	0.8	23.0	28.8
Hickerson, J. F., La Crescenta, Calif.		11	11:45	16:15	240	119	0.7	19.8	28.3
Simpson, A. M., Red Box Canyon, Calif.	July	26	10:00	15:45	210	113	0.8	32.3	42.9
Mt. Wilson Obs., Calif.		28	10:35	15:45	165	144	0.9	52.3	58.1
La Crescenta, Calif.	Aug.	11	11:45	16:15	270	146	0.6	32.4	54.0
Non-Members Reporting to J. W. Simpson									
(*4) Lindsay, P.,	July	28	12:30	13:55	85	13		9.2	
Los Angeles, Calif.	Aug.	11	12:20	16:15	235	73		18.6	
Lucy, A., Palo Alto, Calif.		12	11:30	12:30	60	21		21.0	
Schvonover, G. S., Oakland, Calif.		11	12:00	14:15	135	9		4.0	
Patterson, T. M., Mt. Wilson Obs.		11	11:20	13:20	120	88	0.7	44.0	62.8
Ellis, G., Mt. Wilson Obs., Calif.		11	11:30	16:15	285	266	0.6	56.1	93.5
Lyttle, M., Mt. Wilson Obs., Calif.		11	11:30	16:15	285	266	0.6	56.1	93.5
Hammond, C., Mt. Wilson Obs., Calif.		11	11:30	16:15	225	225	0.6	60.0	100.0
Holmes, C. W.,	July	28	10:50	15:45	255	88	0.8	20.7	25.9
Mt. Wilson Obs., Calif.	Aug.	11	10:50	16:05	285	188	0.7	39.6	56.6
		12	11:45	15:30	225	63	0.8	16.8	21.0
Thompson, K., Red Box Canyon, Calif.	July	26	10:00	15:30	210	66	0.8	18.8	23.5
Pederson, J. A., Barley Flats, Calif.	Aug.	11	11:20	14:50	90	60		40.0	
Pagen, J., Buckner, Ill.		11	9:00	11:00	120	133		66.6	
(*10) Rupert, S., Exiter, Calif.		10	10:05	12:45	160	60		22.5	
(*11)		11	13:20	15:00	100	127		76.2	
Reeder, Mrs. R. J., Flat River, Mo.		16	9:00	13:00	240	66		16.5	

Remarks.

(1) 8 plotted. (2) 8 plotted; 29 Perseids. (3) Count: 6 Perseids. (4) Plotted. (5) Clouds at end. (6) One assistant; notes on each, with *h* and *a* given for most. (7) 32 Perseids. (8) Same number counted by each of three other observers. (9) From window; many other small ones. These paths plotted. (10) Four assistants. (11) Three assistants.

As the epoch for the Leonids draws near, it becomes necessary to outline our plans for their observation. As a good shower appeared in 1931, and as that of 1932 was fairly good considering the prevailing miserable conditions of cloud and moonlight, our hopes for an excellent shower in 1933 are still high. After all, this is exactly one hundred years, or three full revolutions of the main group of Leonids, since 1833, when the finest shower of all came. True, perturbations did sad work before 1899 and 1900, but there is no certainty that other perturbations since then have not partly undone this harm. Calculations on the subject contain so many unknown or partly known quantities that one dare not make absolute predictions. Such being the case, we should be more than foolish not to make full preparations in hopes of a fine shower.

As in 1932, there will be a large mid-Atlantic network of stations with Baltimore somewhere near the center, which will work for simultaneous observations of the same meteors. Above everything we want accurate plots of any fireball leaving a long-enduring train, and plots to scale of the train at one-minute intervals. Observers are urged to lose no opportunity to make this most valuable set of records. Next in importance is the determination of heights, particularly of the brighter meteors, by simultaneous observations from two or more stations. Lastly, the hourly rates can be counted by the less experienced members of observing parties. Those observatories or individuals owning cameras or photographic telescopes suitable for meteor photography are urged to employ them. Suggestions for photographic work will be sent on request.

Our regional directors or local organizers in Arizona, Florida, Georgia, Michigan, Missouri, New York, Ohio, Oregon, Tennessee-Kentucky, Texas, and Wisconsin-Illinois have been urged to undertake the organization of parties for careful observational work. Isolated members and other interested persons are requested to make observations in the usual way; those with maps, to observe and plot according to regular instructions; those without maps, to make individual hourly counts for as many hours of each night as it is practical to observe. To all new observers the warning is given that November nights are usually cold; very heavy clothing should be worn; otherwise the observer will be driven indoors by the cold.

In general, one hundred miles should be the maximum distance between coöperating observers; thirty miles should be the minimum. We ask all our members who will need maps to send in their requisitions as early as possible; otherwise they may be too late. Eleven in the evening is as early as it is wise to start observations; Leo is about on the meridian at dawn. The maximum is expected on the night of November 15-16, but our eastern stations will also work on November 14-15 and 16-17 in case the shower is a day early or late. As this is probably the last chance for a great Leonid shower until 1966, we urge that everyone be prepared. We shall be glad to furnish maps and blanks to volunteers who know the constellations and are willing to follow instructions.

Most unexpectedly on October 9 a very fine meteor shower appeared over Europe. The Poulkovo Observatory reported that the maximum came at 20^h U.T., and that the radiant was near ν Draconis. Over 100 meteors per minute appeared. Press reports said that the shower was observed also in Belgium, France, Germany, and Portugal, and was most striking. An examination of a table of possible cometary radiants (*Monthly Notices*, June, 1920, pp. 739-741) published by the Rev. Mr. M. Davidson of England notes that the orbit of Giacobini's Comet comes within 0.06 A.U. of the earth's orbit on October 9, and that the radiant point of meteors connected with this comet would be $\alpha = 251°.5$, $\delta = +55°.9$, the earth meeting the meteors in the descending node. A search of about 2000 catalogued A.M.S. radiants shows no radiant for October within 10° of ν Draconis. Denning's *General Catalogue* also gives no radiant for early October within 10° of ν Draconis. This catalogue was fairly complete up to 1899 for European observations. Dr. W. J. Fisher of Harvard publishes: "Observations of this shower seem to have been made in 1841, 1900, and 1926." I have found one of these references, but have not had time to look for the two earlier. Dr. Fisher's reference for 1926 is to some 36 meteors in 3 hours on October 9 seen by Prentice in England which gave a radiant near ν Draconis. It may, however, be assumed with fair safety, I believe, that the shower of 1933 is the first of really large proportions furnished by Giacobini's Comet. Perturbations in recent years evidently

shifted debris along the comet's orbit into the earth's path. This shower is a welcome addition to the few proved connections between comets and meteor streams. More cannot be said about this interesting display until further details arrive from Europe.

Flower Observatory, Upper Darby, Pennsylvania, 1933 October 16.

The Fireballs of September, 1933

By C. C. WYLIE

September 15, 1933, was very unusual in that two brilliant meteors, each bright enough to attract attention over several states, fell in adjoining midwestern states. Both fell in the early evening hours while many people were outdoors, sitting in their yards or porches, riding in cars, or watching night ball games. One hundred and thirty-two reports have been received on the two meteors. No computation has been made on either, but some estimates have been made from an inspection of these first reports.

The earlier of the two meteors fell at 7:27 P.M., 90th meridian time, and attracted attention in the states of Kentucky, Indiana, Illinois, Missouri, and Iowa. It was observed by several persons in and near Iowa City, Iowa, but our first notification was a telegram from Mr. Thomas M. Galey. He observed it from near Owensboro, Kentucky. This meteor fell in a general way from north to south, and perhaps ended over a point southeast of Centralia, Illinois. No detonations have been reported.

The second meteor fell at about 8:55 P.M., 90th meridian time, and has been reported from the states of Kentucky, Indiana, Illinois, and Missouri. It was even more brilliant than the first meteor, newspapers in Kentucky, Indiana, Illinois, and Missouri publishing items. The account of an aviator who observed it from near Terre Haute, Indiana, added much to the news value of these items. This meteor fell from southeast to northwest, ending over a point north and west of Bloomington, Indiana. Several reports include the statement that detonations were heard after the fall of the meteor. They come from the area in which detonations should have been heard if the meteor caused any; but Professor W. A. Cogshall, of Indiana University, regards the detonations as "not proven." There had been a thunderstorm in that district, and there was still occasional thunder.

In conclusion we wish to thank the following persons who were especially active in securing information on these meteors: Professor W. A. Cogshall, Indiana University, Bloomington, Indiana; Professor Waldemar Noll, Berea College, Berea, Kentucky; and Mr. Thomas M. Galey, of Owensboro, Kentucky.

University of Iowa, October 22, 1933.

Dubuque Counts of the 1933 Perseids

Coöperating with the University of Iowa and the Midwest Meteor Association, the students of Columbia College, Dubuque, Iowa, carried on as their part of the program a systematic count of the Perseid meteors during the height of the shower. Two distinct groups of experienced observers were organized, one stationed at Dubuque, Iowa, and the other at Cedar Rapids, Iowa. In addition to group counts, solo counts were likewise made at three separated points. Alvin Jaeger was stationed at Dubuque, Charles Seda at Cedar Rapids, and Michael Cavanaugh at Harper's Ferry, Iowa. Each of the solo observers has had considerable experience in meteor counts.

Weather conditions for the week were generally favorable. The Cedar Rapids group reported an ideal sky for the mornings of August 10, 12, 13. On August 8 and 9 clouds interfered considerably at all stations. August 11 was overcast both at Harper's Ferry and at Dubuque, though the former station was able to carry on for 45 minutes. At Cedar Rapids rain fell at midnight of August 11, but a timely breeze cleared the sky at 13:45, after which time a good count could be secured. The moon was very troublesome during the entire week during which observations were made. It is the opinion of the young observers that under the same sky conditions, as existed last year, the shower of this year would have been superior to that of both 1931 and 1932.

The counts for the solo observers have been averaged for the hour 14:00 to 15:00. They are as follows: the 9th, 28; 10th, 46; 11th, 91; 12th, 46; and 13th, 28. This indicates a definite maximum on the night of the 11th. These counts indicate also that the maximum occurred on this side of the earth. Numerous reports came in citing unusual meteor activity in the early evening hours. Perseids in considerable numbers were seen as early as 8:30 o'clock. On August 12 a group of seven, located so that only a small portion of the eastern sky was visible, recorded a total of 93 Perseids in the period from 8:30 to 10:00.

A number of spectacular meteors were likewise reported, particularly on the peak nights. These were described as "slightly brighter than the ordinary electric light bulb" and leaving trains visible for a considerable length of time. On August 12 two such spectacular meteors were reported for the early evening hours, one at 8:30 and a second at 9:02. Each started overhead and traveled in the center of the Milky Way, disappearing below the horizon.

Following is a detailed report of the counts for the entire period from August 7 to 13. The times are noon-to-noon reckoning and for the 90th meridian.

1933 Aug. 8 *Cedar Rapids,* 5 in group

15-minute Period	Group Count	Leaving Train	Solo Count
12:00-12:15	3	0	2
12:15-12:30	5	1	3
12:30-12:45	2	0	1
12:45-13:00	2	1	2
13:00-13:15	2	0	1
13:15-13:30	**	.	**
13:30-13:45	**	.	**
13:45-14:00	3	1	2
14:00-14:15	2	0	1
14:15-14:30	1	0	1
14:30-14:45	**	.	**
14:45-15:00	**	.	**

Aug. 10 *Cedar Rapids,* 6 in group

15-minute Period	Group Count	Leaving Train	Solo Count
12:00-12:15	16	2	6
12:15-12:30	19	3	8
12:30-12:45	12	0	7
12:45-13:00	15	2	7
13:00-13:15	14	1	6
13:15-13:30	13	1	7
13:30-13:45	19	1	9
13:45-14:00	19	2	7
14:00-14:15	28	3	16
14:15-14:30	25	0	11
14:30-14:45	30	2	13
14:45-15:00	26	4	12
15:00-15:15	31	3	15
15:15-15:30	34	6	22

Aug. 10 *Dubuque,* 6 in group

15-minute Period	Group Count	Leaving Train	Solo Count
12:00-12:15	.	.	.
12:15-12:30	.	.	.
12:30-12:45	8	1	2
12:45-13:00	19	1	10
13:00-13:15	12	1	5
13:15-13:30	12	4	8
13:30-13:45	11	2	7
13:45-14:00	20	4	9
14:00-14:15	21	3	8
14:15-14:30	16	3	7
14:30-14:45	16	2	10
14:45-15:00	12	2	9

Aug. 10 *Cedar Rapids,* 3 in group

15-minute Period	Group Count	Leaving Train	Solo Count
12:00-12:15	**	.	**
12:15-12:30	**	.	**
12:30-12:45	**	.	**
12:45-13:00	30**	2	16**
13:00-13:15	24**	3	14**
13:15-13:30	25**	2	14**
13:30-13:45	24*	4	13*
13:45-14:00	33	3	18
14:00-14:15	32	4	20
14:15-14:30	56	7	33
14:30-14:45	41	14	20
14:45-15:00	35	5	18
15:00-15:15	54	6	31
15:15-15:30	27	2	16

1933 Aug. 12 *Cedar Rapids*, 4 in group

15-minute Period	Group Count	Leaving Train	Solo Count
12:00-12:15	13	1	9
12:15-12:30	14	2	8
12:30-12:45	22	3	12
12:45-13:00	39	5	19
13:00-13:15	24	4	15
13:15-13:30	23	3	11
13:30-13:45	20	3	10
13:45-14:00	24	4	12
14:00-14:15	30	6	13
14:15-14:30	33	5	12
14:30-14:45	15	2	8
14:45-15:00	29	3	12
15:00-15:15	40	5	19
Aug. 12 *Dubuque*, 7 in group			
8:30- 8:45	17	.	.
8:45- 9:00	18	.	.
9:00- 9:15	14	.	.
9:15- 9:30	22	.	.
9:30- 9:45	14*	.	.
9:45-10:00	8**	.	.

Aug. 12 *Dubuque*, 4 in group

15-minute Period	Group Count	Leaving Train	Solo Count
13:00-13:15	20	3	10
13:15-13:30	18	2	6
13:30-13:45	23	2	11
13:45-14:00	28	7	13
14:00-14:15	35	11	19
14:15-14:30	35	9	18
14:30-14:45	30	5	14
14:45-15:00	21	4	9
Aug. 13 *Cedar Rapids*, 2 in group			
12:00-12:15	6	1	4
12:15-12:30	10	3	6
12:30-12:45	15	4	9
12:45-13:00	11	1	7
13:00-13:15	15	1	9
13:15-13:30	12	3	7
13:30-13:45	13	1	8
13:45-14:00	12	1	7
14:00-14:15	13	3	7
14:15-14:30	13	2	8
14:30-14:45	11	3	7
14:45-15:00	13	1	9
15:00-15:15	10	0	6

Solo Counts at Harpers Ferry.

15-minute Period	Aug. 7	Aug. 8	Aug. 9	Aug. 10	Aug. 11	Aug. 12	Aug. 13
12:00-12:15	4	**	9	17	28	11	**
12:15-12:30	6	**	11	24	18	8	**
12:30-12:45	11	**	21	18	19	7	3
12:45-13:00	4	2	9	11	**	6	7
13:00-13:15	3	1	7	14	**	17	**
13:15-13:30	2	*	6	17	**	9	**
13:30-13:45	3	*	4	9	**	8	**
13:45-14:00	4	*	3	6	**	11	4
14:00-14:15	6	*	5	5	**	9	6
14:15-14:30	7	*	7	26	**	4	7
14:30-14:45	1	3	8	11	**	3	**
14:45-15:00	2	2	8	9	**	16	**
15:00-15:15	0	.	.	8	**	*	**

*Sky hazy. **Sky cloudy.

Group Observers.

Cedar Rapids—A group of students located on the roof of St. Ludmila's school, outside of the city of Cedar Rapids, Iowa, and away from street lights. The following are the members of the group: W. Xavier Cole, John Slabach, John Lambert, Edwin Tow, George Proskovec, A. Patik, Charles Seda.

Dubuque—A group of students located near Dubuque, Iowa. Following are the members of the group: Alvin Jaeger, Leon Jaeger, Robert Ernsdorff, Lester Cooling, Milton Weimer, Gordon Saunders.

Solo Observers.

Cedar Rapids—Charles Seda. Harpers Ferry—Michael Cavanaugh. Dubuque, Iowa—Alvin Jaeger.

John A. Theobald.

Columbia College, Dubuque, Iowa.

Notes from the Society for Research on Meteorites

By FREDERICK C. LEONARD, President and H. H. NININGER, Secretary

A Suggested Program of Research on Meteorites*

By H. H. NININGER

1. The need for a more thorough study of the mineralogical and metallurgical characteristics of meteorites, with a view to a more satisfactory classification of specimens.

2. Correction of erroneous identifications in collections.

3. Extension of our knowledge of what may fall as meteorites:

(a) Some of the types now recognized have been known to fall only once or twice in the course of the 141 years since Chladni advanced the theory of meteorites. It is altogether probable that types other than those recognized, fall rarely, but have not yet been identified as meteoritic falls.

(b) In any extension of our knowledge in this direction extreme care must be exercised to avoid unwarranted conclusions. The Society for Research on Meteorites can serve as a clearing house for problems which arise in this connection.

4. Extensive field research, such as that which is now being carried on by the Nininger Laboratory, to ascertain the distribution and the frequency of meteorites in the earth's surface, will in time yield very valuable information as well as more abundant materials for use in laboratory studies. This search may be considered under two divisions:

(a) Meteorites of ordinary size;

(b) Meteorites of huge size, and meteor craters, which can best be located by a combination of aërial, topographical, and sub-surface surveys by geophysical methods.

5. Relation of meteorites to earth-growth, both past and present, will prove a very important and fruitful field:

(a) As evidenced in traces of huge crater-producing meteorites;

(b) As evidenced by traces of meteorites in various geological formations, when we have learned to recognize them;

(c) As evidenced by the possible causal relation between certain major topographical features of the earth and the impact of meteorites of asteroidal dimensions.

6. The possible relation of huge impacts to the glacial periods and the shifting of the poles of the earth.

7. Publication of readable and authentic information on meteorites and meteors.

8. Surveys and analyses of meteor clouds as to their true nature, formation, volume, weight, luminosity, drift, *et cetera*.

9. Just how significant are the present-day meteoritic additions to the earth's atmosphere?

The Nininger Laboratory, 1955 Fairfax St., Denver, Colorado.

*The outline of an address delivered before the organization meeting of the Society for Research on Meteorites, in Chicago, Illinois, August 21-22, 1933.

Some Remarks on the Science of Meteoritics*

By Frederick C. Leonard

The word *meteoritics* appears to have been employed first by Dr. O. C. Farrington in the following passage from his treatise on *Meteorites:*

"For the science which has for its field the study of meteorites, several names have been proposed, but none has yet received general adoption. Shepard suggested 'astrolithology,' meaning lithology of the stars, but meteorites are now considered to be quite distinct from the stars. Maskelyne proposed 'aërolitics,' but the term refers to but a single group of meteorites according to a distinction made by Maskelyne himself. By using the term 'meteoritics' the objection mentioned may be overcome and this name may in time gain adoption. The science of meteorites obviously looks to many other sciences for its data and growth. The science of astronomy throws light on the relations of meteorites to the other heavenly bodies; the sciences of geology, petrology, and mineralogy elucidate the relations of meteorites to the earth and its rocks and minerals, and the sciences of physics and chemistry afford means for the analysis of the structure and composition, spectroscopic characters, etc., which distinguish meteorites from other bodies."

Since obviously no more fitting name than *meteoritics* is applicable to the science of meteorites, we may hope that that word will be generally accepted.

In his recent book, *Our Stone-Pelted Planet,* Professor H. H. Nininger defines *meteoritics* as "The science of the study of meteorites and meteors." He previously defines a *meteorite* as "A mass of solid matter, too small to be considered an asteroid; either traveling through space as an unattached unit, or having landed on the earth and still retaining its identity," and a *meteor* as "The light phenomena occasioned by a meteorite plunging into the earth's atmosphere from space."

Professor Nininger uses the single term *meteorite* in the combined sense of *meteoroid,* defined by Webster's *Dictionary* as "One of the countless small bodies in the solar system, which become meteors on entering the earth's atmosphere," and *meteorite,* defined as "A stony or metallic body fallen to the earth from outer space." This dictionary defines a *meteor* as "a meteoroid heated to incandescence by friction in passing through the atmosphere." Clearly, all meteorites were successively meteoroids and meteors, in the Websterian sense, before they arrived on the earth's surface, but very few meteoroids or meteors become meteorites. Taking Webster's definition of a *meteorite* as a "body fallen to the earth from outer space," I shall, with Dr. Farrington, define *meteoritics* as "the science of meteorites." Since the words *meteoroid, meteor,* and *meteorite,* in the Websterian import, are all convenient terms, the distinctions between them should be preserved, unless it is agreed with Professor Nininger to make the one word *meteorite* mean both *meteoroid* and *meteorite* and to define a *meteor* as merely "the light phenomena occasioned by a meteorite plunging into the earth's atmosphere from space." This practice is defensible on the ground that the essential nature of a *meteoroid*—at least if it be sufficiently massive to penetrate to the earth's surface—is unaltered by its transit through the atmosphere; in other words, that meteoroids and meteorites are, after all, fundamentally the same kind of bodies.**

*The substance of an address delivered before the organization meeting of the Society for Research on Meteorites, in Chicago, Illinois, August 21-22, 1933.

**If a *meteoroid* disintegrates in its flight through the atmosphere and produces a number of *meteorites,* it may be questioned whether, in such cases, meteoroids and meteorites are, technically speaking, the same sort of bodies.

As Dr. Farrington has pointed out in the excerpt previously quoted, meteoritics is a hybrid science. It has contacts with practically all the physical sciences —and, we shall have to add, with a biological science, bacteriology, as well, if Dean Lipman's recently reported discovery of bacteria in meteorites is true! The professional affiliations of the members of this Society show how manifold are the sciences which contribute to meteoritics.

From the point of view of epistemology, meteoritics is plainly a subscience of astronomy, for meteorites are primarily astronomical bodies. The development of the subject has, however, been in the hands largely of geologists, who have taken a more lively interest in meteorites than astronomers. The reason for this fact is readily explained. The analysis of bits of stone and metal, even though they have descended from the skies, has seemed doubtless more appropriate to petrology and mineralogy than to the popularly so-called "science of the heavenly bodies." But because meteorites are the only cosmic masses, other than the earth itself, of which we have tactual knowledge, their study belongs more properly to astronomy than to any other field.

Meteoritics is a nascent science, with the vigor of youth and a promising future. To classify the subject as a branch of astronomy is not to belittle it, for astronomy embraces the cosmos. Meteoritics is simply that part of astronomy which deals with the investigation of the sole material links between the earth and the rest of the universe.

Department of Astronomy,
University of California at Los Angeles,
August, 1933.

Three Fireballs on September 17, 1933.

On the night of September 17, 1933, I was observing variable stars. At about 8:45 P.M., C.S.T., a bright fireball appeared near β Cephei. It was about magnitude —9, and cast strong shadows. The light was white in color and flickered considerably. The apparent diameter of the object was about 12′. Its motion was rapid, and it disappeared 5 degrees north of α Persei, leaving no noticeable train.

The second fireball was reported to me by James Johnson. It appeared at 7:10 P.M., was about half as bright as the full moon, and it appeared at altitude 45 degrees, in the southeastern sky, and disappeared at about 30 degrees altitude in the southwest, leaving a train. The motion was rapid.

The third fireball was seen by Earl Yterler about 10:30 P.M. It was bright green in color and was about two-thirds as bright as the full moon. It appeared in the southeast at an altitude of about 40 degrees and vanished below the horizon, nearly due south. According to Yterler, its motion was slow, and it remained visible for about 10 seconds.

NOAH W. MCLEOD.

Christine, North Dakota.

Comet Notes

By G. VAN BIESBROECK

This month has been marked by an astronomical event which, although not strictly in line with the subject of these notes, is so closely connected with it that it should be mentioned here: we refer to the magnificent meteoric display which occurred on October 9 in Europe.

On the evening of that day the central bureau for telegraphic information at

the Harvard College Observatory received several cablegrams from abroad reporting the phenomenon: from Belgium, from Poland, and from Russia. Press reports later showed that it had been witnessed also in Germany and in Portugal. At the time of writing no report is at hand from any place farther east than the Pulkovo Observatory near Leningrad. The meteor shower was reported from there as being of short duration but very abundant since more than a hundred meteors were counted per minute, emanating from a radiant near ν Draconis. The shower evidently lasted only a short time. When night reached this country no unusual meteoric activity could be established any longer. At Williams Bay a couple of shooting stars coming from the Draco region were noticed on October 10 at about $2^h\ 30^m$ U.T. in a break through the clouds. But later in the night the sky cleared and there was evidently nothing left of the impressive display which had taken observers by surprise.

What interests us here especially is the evident connection of this meteoric shower with periodic Comet Giacobini 1900 III which this year has been under observation since last April under the designation 1933 *c*. Several times in the past some members of this same shower have been noticed on October 9, the last time in 1926 when it was found that these "Draconids" moved in the orbit of the above periodic comet. In that year the earth came within 5 million miles of its orbit. For the present return of the comet F. R. Cripps established an orbit which proved to be very nearly correct. When we use his elements we find that on October 9.82 U.T. the earth passed through the plane of the comet's motion and that we were at that moment within 370,000 miles, only one and a half times the mean distance of the moon, from the orbit itself. The comet had passed that point last July 21 and is now at a great distance from us, but evidently some of the cometary material distributed along its path has come within the earth's atmosphere at the very moment when we were closest to the orbit. None of the previous showers of October 9 have even approached the abundance of this year's display. From the fact that the earth came so near to the orbit of the comet the phenomenon might well have been foreseen but there has been evidently the additional lucky circumstance that a strong condensation of meteoric material was just traveling on that part of the orbit that we approached so closely on October 9.

The periodic comet itself has remained very inconspicuous and difficult to observe all through this return. I secured one more photographic observation here on October 18 when the comet was reduced to magnitude 16 but still showed a short tail pointing away from the sun. It is not probable that many more observations will be obtained.

There are no reports at hand of late observations of Periodic Comet 1933 *b* (Pons-Winnecke) in the southern hemisphere, nor of the extremely faint Periodic Comet 1933 *e* (Wolf) which seems to have been recorded only at the Lick Observatory (p. 440).

But Comet 1932 *g* (Geddes) remains in reach and was photographed here in the morning sky on October 17 as a small round coma of magnitude 14. It has now passed conjunction with the sun and will presumably remain under observation for several months more in spite of its fading due to increasing distance. There is, however, a compensation through improving conditions of visibility at higher altitudes above the horizon. The course of this object has now been followed for sixteen months.

No other comets are expected this coming month.

Williams Bay, Wisconsin, October 19, 1933.

POST SCRIPT.

New COMET 1933 *f* (WHIPPLE). The sixth cometary discovery of the year has just been reported in a telegram broadcast in the night of October 20-21 by the Harvard College Observatory. The object was first found by Whipple on a photograph made with the 16-inch Metcalf telescope at the Oak Ridge (Mass.) station of that observatory on October 15.3. This was confirmed by several photographs of October 20. The first telegram gave the following information:

1933 Oct. 21.123 U.T. $3^h\ 23^m$ $+9°\ 22'$ Magnitude 13.
Daily motion west 27ˢ south 7′ 30″.

The next night the object was photographed by the writer with the 24-inch reflector of the Yerkes Observatory. The comet appeared as a fairly well defined round coma out of which emanated a faint tail some 3′ long in position-angle 280°. But the total light being hardly as bright as a 13th magnitude star the comet can be seen to advantage only in large telescopes.

Accurate observations by Whipple and Cunningham at Harvard and by the writer are now available:

1933	h m s	° ′ ″	
Oct. 15.2749	3 25 19.6	+10 2 12	Harvard
21.1226	22 55.0	9 19 38	Harvard
22.2142	22 23.4	9 11 39	Yerkes
23.2826	21 51.1	9 3 47	Yerkes

The position and the motion of this little comet show analogy with the behavior of a small planet and an elliptic orbit of short period was to be expected. This has already been confirmed by the discoverer who has computed a preliminary orbit from the positions on October 15, 21, and 22 with the result:

Date of Perihelion	1933 July 8.43 U.T.
Longitude of node	188° 9′
Node to perihelion	182 21
Inclination	10 4
Eccentricity	0.4086
Perihelion distance	2.410
Period	8.23 yrs.

These give the ephemeris:

1933	h m s	° ′	Light
Oct. 27	3 19 52	+8 37	1.00
31	17 31	8 8	
Nov. 4	15 0	7 41	
8	12 23	7 14	0.97

The orbit has some resemblance to that of asteroid 719 (Albert) which has nearly the same period. The comet, which is situated in the western part of Taurus, comes to opposition November 12 and is therefore visible throughout the night but its increasing distance reduces its brightness so that it will not become a bright object.

October 24, 1933.

Zodiacal Light Notes

By FRANKLIN W. SMITH

The morning Zodiacal Light was observed from 4:30 to 4:45 A.M. on September 30. Its northern edge was just north of η Leonis and γ Cancri. The southern edge passed approximately through α Cancri, and two or three degrees south of o Leonis. The apex was in Gemini, but was too near the Milky Way to be located

accurately. These boundaries locate the light cone so that its axis falls quite close to the ecliptic. On October 17 (from 4:45 to 5:00 A.M.) the northern boundary was found to pass through η Leonis and the southern, through o Leonis. The apparent apex was just west of Praesepe. The axis, therefore, practically coincided with the ecliptic and the elongation of the apex was about 80°. No fluctuations in the light were noticed on either occasion.

The Gegenschein was observed at 11:00 P.M. on Ocotober 15. It appeared to be nearly circular and about 15° in diameter. The center was probably a few degrees north of o Piscium. The Gegenschein is now in a quite favorable position for observation from northern latitudes because it is north of the equator and is in a region containing no bright stars. It will, of course, continue northward, but when it reaches its greatest declination north at the solstice it will be entirely lost from sight in the greater brightness of the Milky Way.

407 Scott Ave., Glenolden, Pennsylvania, October 17, 1933.

Notes from Amateurs

Astrolab Progress Report

We have had several informal committee conferences at Astrolab headquarters during the summer. Definite progress has been made since the club was launched in January, and it has become necessary to revise and enlarge the committee lineup for 1934. This proposed program is contained in the October issue of the Astroscope, a mimeographed bulletin published by L.I.B. for Astrolab. The Astroscope has been enlarged to meet the increasing amount of material to be covered on optics and astronomy, as well as activities of the members of Astrolab.

The first units of seven Polar Bowl mountings are well under way, in addition to the partially completed one that was sent to Fort Worth for the first southern convention of the A.A.V.S.O. Patterns for the cone bearing fork mounting are completed, and, by the time this article is published, castings should be ready. This design is for a 6½-inch reflector of very easy portability.

One of the problems that has been causing a great deal of committee work in the month of September is that of a synchronous clock drive for the Polar Bowl for photographic use. The resulting design permits hand adjustments while the synchronous clock is operating, *i.e.* the hand slow motion and synchronous clock work in tandem, not parallel. The utmost in fine adjustments is thus possible. Blue prints are available, in fact, blue prints and photographs of practically all sub-assemblies are now ready. Interchangeable gears make this hand slow motion gear ratio so high that it will be possible to use a reversible motor for accurate control electrically.

A Southern California group meeting was held in Riverside, California, on September 24. The Riverside group is very active both in astronomy and instrument design and construction. A. M. Brown talked on "Producing Accurate Optical Surfaces on Glass." H.P.B. demonstrated his portable split ring mounting with his newly developed cast aluminum tube, a very rigid steady design. A.E.J. has designed a very rigid tripod for portable telescopes, and more important,—a phonograph motor controlled by a clock escapment that is particularly desirable for portable telescopes used where electricity is not available. This meeting in Southern California is fully covered in the Riverside issue of the Astroscope.

W.H.F. has completed the translation of the Schwartzschild paper on the

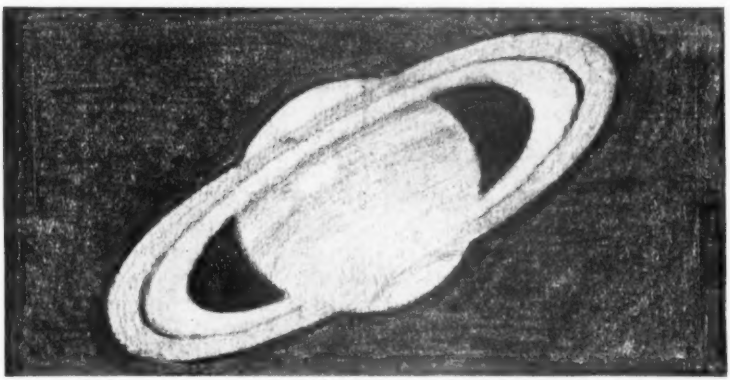
Aplanatic Telescope, and is having about twenty copies made for Astrolab. A few of these copies will be for sale to cover costs, and the balance for rental through the Astrolab library.

Astrolab invites the correspondence of interested observers. For additional information about this coöperative group see POPULAR ASTRONOMY, January, 1933, through October, 1933, or write L. I. BUTTLES.

10728 S. Artesian Avenue, Chicago, Illinois, October 15, 1933.

Observations of Saturn.—Herewith I take the liberty of sending you a drawing which I made of the planet Saturn on the night between August 6 and 7. It was made by the aid of a 16-inch reflector at the Goddard Observatory here in Portland.

It is so seldom that we have perfect "seeing" here that when we do have it the event becomes an occasion. On the night indicated the air was very clear and remarkably steady. In addition to his 16-inch Mellish reflector, Mr. Goddard has a 4-inch refractor. On ordinary nights the refractor renders much the better defin-



AUGUST 7, 1933. 1:00 A.M.

ition except in the case of faint objects such as nebulae and star clusters when the superior light gathering power of the reflector becomes very evident. By means of it we can see many of the individual stars in the well-known cluster in Hercules.

Mr. Mellish, the maker of the 16-inch, claims that on good nights he has used a power of 800 on it to good advantage. However, it is but seldom that we can use a higher power than 256. But, as already stated, on the night between August 6 and 7 the 16-inch literally stepped right out and revealed details on Saturn that I have never seen before. The drawing represents Saturn as seen in the 16-inch with a power of 640. On that night the crepe ring could be seen like a delicate tracing where it crossed the planet's disc. Cassini's Division stood out boldly, like a black inkline. On the disc itself I could see a brilliant white spot. It appeared near the center and to me it seemed to be an intensification of a rather bright belt that crossed the disc. The regions below that belt were decidedly dusky. I saw five moons but Mr. Goddard claims that he could see seven. After about two hours the brilliant spot had moved to the edge of the disc, thus demon-

strating the rapid rotation of the planet. Altogether, it was a scene of loveliness and surpassing grandeur which must be seen to be appreciated. Seen through a powerful instrument it is hard to believe the ancients could ascribe an evil influence to Saturn.

ARTHUR JOHNSON.

1310 N. E. 49th Avenue, Portland, Oregon, August 15, 1933.

Amateur Telescope Makers of Chicago

The Amateur Telescope Makers of Chicago met at the Dearborn Observatory, Northwestern University, Evanston, Illinois, on the evening of Saturday, October 7.

We were welcomed by Dr. Lee, who put the 18-inch Clark refractor into action. We had a number of visitors from the Indianapolis Amateur Astronomers Association, including V. E. Maier, Secretary, and his brother Ernest.

The Chicago A.T.Ms. and their visitors enjoyed the meeting very much and highly appreciate the kindness of Dr. Lee and the Dearborn Observatory in allowing us to see this splendid instrument.

WM. CALLUM, *Secretary.*

1319 W. 78th Street, Chicago, Illinois, October 16, 1933.

Observations of the Rotation Period of the Planet Venus

A series of sketches of the planet Venus showing some detail have been made by the writer with a 6-inch reflecting telescope and a set of eyepiece diaphragms and filters. The late Professor Barnard suggested the use of diaphragms at the eye-lens of the eyepiece for reducing the glare of the planet and sharpening the image. It has been found that there is a great increase in clarity by stopping the eye lens down to about three-sixteenths of an inch aperture, and by using "indirect vision," that is, viewing Venus from the edge of the eyepiece rather than looking directly at the brilliant surface. The writer also has used successfully dark glass or filters at the eyepiece, and finds that a deep red, gelatine shade gives best results when used with the diaphragm. A long focal ratio, that of F. 10, reduced glare, chromatic aberration and "boiling" of the image materially. As another aid to seeing, the observer's head and the eyepiece were covered by a dark camera cloth, thus shutting out extraneous and disconcerting light.

From observations of an apparent bright, diffuse region in the northern hemisphere, which though it diminished in size was still recognizable, a period of rotation for the spot, and for the planet at the equator was calculated. The motion was observed over a period of fifteen days from August 4 to 19, and was found to amount to roughly an average of 640 miles per earth-day. This, when reduced, gives a period of rotation for the spot of 34.57 earth-days; and supposing that the spot is not moving relative to the planet's surface,—a period of rotation at the equator of 37.19 earth-days.

This period is of course open to error since the measurements made were rough. However, it compares quite favorably with that calculated by Slipher from spectroscopic studies of the inclination of the lines of the planet's spectrum due to rotation, fixing the period *between thirty and forty days.* It also compares favorably with Ross' estimate of thirty days, obtained from ultra-violet light photographs, and with several other similar modern estimates.

For more excellent definition stopping out the edges of the field lens of the eyepiece is suggested; and also diaphragming down the aperture of the speculum or object glass of the telescope. A 3-inch refractor of 40 inches focus was diaphragmed down to one inch clear aperture and gave vastly improved results using

a magnification of 200. Further work on Venus with this refractor using the objective and eyepiece diaphragms, as well as a series of Wratten filters *at the objective*, is being undertaken.

EDWIN P. MARTZ, JR.

729 N. Elmwood Avenue, Oak Park, Illinois, September 1, 1933.

A New Comet-Seeker

The following note is merely a suggestion, but perhaps of some interest both to amateurs and professionals.

In his enjoyment of the beauties of the heavens, and particularly with advancing age, the amateur is always asking for more light; and the thought comes: "What would be the appearance of such asterisms as the Pleiades, the Coma cluster, Praesepe, η Telescopii, or No. 7 Messier, the double star-cluster in Perseus, and the like, if only, we had some such instrument as a Cassegrainian reflector of some twelve inches aperture, of very short focus (say only two or three feet), with very wide fields, and naturally of very low power? Now, no human eye has ever seen such a view; and the magnificent photos of large instruments, well they tell us much, but they do not tell what we want: How these things look to the eye, with plenty of light. Of course, primarily, this suggested thing is merely a toy for the amateur; but note its promising use as a Comet-Seeker.

Whatever be the probable facts, the impression persists that many comets may escape the field of the large telescopes, which are quite properly otherwise occupied. Several years ago, in Newtonville, Massachusetts, just after sunset, I saw a magnificent comet, larger and brighter than Halley's at its last appearance; and this fine visitor had come almost unheralded, and with scant note as it quickly faded away.

Now, if several hundred amateurs, scattered over the face of the globe, were provided with such powerful light-gatherers, as that suggested, it would not be possible for any casual comet to come and go unnoted. And so, this further addition to the equipment of the amateur might serve, not only for much real pleasure, but also for much extension of our knowledge of the heavens.

CHARLES SKEELE PALMER.

4333 Dakota St., Oakland Station, Pittsburgh, Pennsylvania, July 25, 1933.

General Notes

Dr. W. W. Campbell, well known as an astronomer throughout the world, and eight other distinguished scientists constitute the Science Advisory Board appointed by President Roosevelt on July 31 of this year.

Mr. J. L. Halpern, graduate student and temporary computer at the Yerkes Observatory, lost his life on a mountain-climbing expedition in Rocky Mountain National Park, in the month of August.

The Abbé Georges Lemaître, professor of astrophysics at the University of Louvain, will be visiting professor at the Catholic University of America in Washington, D. C., for the coming year. Abbé Lemaître will lecture on "Astronomical Applications of the Theory of Relativity" and will conduct a seminar for advanced students of physics and mathematics in the Graduate School of that institution. Abbé Lemaître is known for his contributions to the theory of the expanding uni-

verse. He spent last year at the California Institute of Technology and the Mt. Wilson Observatory engaged in astronomical study. (*Science*, October 13, 1933.)

The Rittenhouse Astronomical Society of Philadelphia met in the hall of The Franklin Institute, 15 South Seventh Street, Tuesday evening, October 17, at 8:00 o'clock. The program was "The Prediction of Eclipses" by Dr. Frank Schlesinger, director of Yale University Observatory. At this time Dr. Schlesinger was presented with the first honorary membership in the Rittenhouse Astronomical Society.

Saturn was recently called upon to play an interesting rôle in connection with the illuminating of the World's Fair in Chicago. As a part of the recognition given to Marchese Guglielmo Marconi at the time of his visit the effect of the light from Saturn in a telescope in Florence was transmitted by radio to Chicago and there it accomplished what the light from the star Arcturus has done repeatedly, that is, furnished the initial impulse for setting the exposition grounds ablaze with light.

American Astronomical Society.—A preliminary notice of the fifty-first meeting of this society has been issued by the secretary, Professor R. S. Dugan. The meeting will be held in affiliation with the American Association for the Advancement of Science, at the Harvard College Observatory, Cambridge, Massachusetts, December 28-30, 1933. Titles of papers should be sent in as early as possible, and certainly by November 30.

Einstein Institute.—The special section of the Astrophysical Observatory in Potsdam which forms the Einstein Institute has been changed by the controlling ministry into "Institute for Solar Physics," according to a statement in *A. N.*, **249**, 13.

Bright Meteors.—On May 21 last at 4:16 A.M., the undersigned observed, at the La Plata Observatory, a very bright meteor, estimated as of the —9th magnitude, or approximately one-twentieth of the brightness of the moon. The nucleus seemed to be white and was surrounded by a diffuse area of between 5′ and 10′ diameter and of a greenish color, such as that of the arc between copper terminals. It left a reddish tail something like the sparks from an anvil and of very brief duration. The apparent observed trajectory was from R.A. $21^h\,16^m$, Decl. —12° to R.A. $0^h\,50^m$, Decl. +9°, approximately, disappearing behind the trees.

Two nights later, May 22, at 11:20 P.M., another meteor similar in color and of the —6th magnitude, or about a twentieth of the brightness of the previous meteor and a little brighter than Venus, was observed. Its apparent trajectory was from: R.A. $16^h\,9^m$, Decl. —63°.5 to R.A. $15^h\,18^m$, Decl. —44°.5. This meteor left a trail which lasted about one second.—BERNARD H. DAWSON.

Our fellow member (of the Argentine Astronomical Association), Jorge Bobone, informs us that on June 16 last, at 5:37 P.M., Argentine Civil Time, he and Mr. Carlos G. Torres observed, from the National Astronomical Observatory at Cordoba, a meteor of great size to the north, despite the intensity of the twilight, the sun having set only 17 minutes earlier. Magnitude was estimated as —5, *i.e.* superior to the brilliance of Venus at its period of maximum splendor. This meteor was visible some three seconds and it left a luminous trail which lasted a brief time. The course of the object at first was rectilinear and its finish was

marked by the explosion of the meteor. Color, yellowish.

As Jupiter was already visible, it was possible to determine with considerable accuracy the apparent course of the meteor. It started at R.A. $9^h\,55^m$ and 14° of declination, ending, after traversing 18°, at R.A. $9^h\,20^m$ and 30° of declination. All of its course was within the constellation of Leo and, as is evident, its origin was near Regulus. (This star, due to the twilight, did not become visible until some moments after the appearance of the meteor.)" (Translated from *Revista Astronomica* by Paul J. Hogan.)

STAR MEN

Dim dawns of antiquity and a clod clung crawling beast,
Never knowing never dreaming of the splendor in the East.
Earth bound mind and spirit only knowing sun and moon,
And but vaguely recognizing night from brightest noon.
Earth filled eyes that only saw
Earth in part, and that was all.

Dim dawns of history and the shepherds watched the sky,
Watched the stars and planets run their course on high.
Saw bright Venus heralding with fire the coming dawn;
Blazing in the ruby sunrise, slowly fading, slowly gone.
Earth filled eyes that this time saw
Part of heav'n, and that was all.

Brighter dawns, and records tell with faded mark
How the Kaldi watched and plotted from the park
All the creatures in the purple vault on high,
Marked Orion, Pegasus, and Lepus in the sky.
Earth filled eyes that somehow lost
Some of earthly blinding gloss.

Greek dawn and the flare of pure impassioned art,
And to the sky came mathematics, with its part
Destined to play the most important role of all,
As the edifice was built, high, proud, and tall.
Earthly eyes that this time saw
Hints of universal law.

Days of darkness when the light of learning shone
But dimly—Astronomy no place to call its home,
With the mighty building crumbling to a fall,
While the Pope's at Rome forbade the phophet's call.
Earth filled eyes that could not see
Great truths of Eternity.

Then from the Slavic forests where the wild still clung,
Came the prophet of the new and of it he sung.
Men fought him with flaming stake and stern decrees,
And forced his Tuscan to recant the views on bended knees.
Earth filled eyes that strove to see
The Cosmos as it's meant to be.

Dawn of the machine and from every land there peers
Thru giant tubes of steel and glass far into years,
Humble man released from earthly bonds and ties
As he travels far thru trackless skies.
Earthly eyes that now are free
All Eternity to see.

BRUCE HEATH.

Book Reviews

Variable Stars.—A new edition of "An Introduction to the Study of Variable Stars" by Caroline E. Furness has recently been issued by the Houghton Mifflin Company, Boston. This work, published originally in 1915, is concerned with a phase of astronomy which has expanded enormously in recent years, and which has contributed much to the development of astronomical theories current today. Consequently, this work, occupying this strategic position, has been of much use to students and to workers in astronomy, and it is gratifying to know that it is now obtainable in this new reprinting. The author states that a complete revision did not seem necessary but a page of *errata* has been inserted, which will add to the value of the book.

An Inquiry Concerning the Chou Pi Suan Ching, by Churyo Nôda. This is a volume printed in Chinese and Japanese and issued by the Academy of Oriental Culture, Kyoto Institute, Kyoto. We learn from the introduction that it "is a book of problematical nature. Although there is no doubt that it is in any case of very ancient origin, yet only very little is known of how it was handed down to us." Due to the study which Dr. Nôde has made of this mysterious work, it has been established "as an invaluable source of information on the development of the astronomical and mathematical sciences in ancient China." It apparently had its origin about two thousand years ago. Even this new version of this work of antiquity is a sealed book to those who cannot read the oriental languages. However, occasionally one finds a diagram, which no doubt has been modernized, or a table of figures which can be understood. For example, there is a tabulation of the obliquity of the ecliptic at intervals of 500 years from the year —3000 to the year +1500, the values of which are said to be in keeping with modern theory. And the English reader is further favored by a fairly detailed outline of the book in English. This volume certainly is of great historical interest as well as of scientific value.

Texas Observers' Bulletin is the title of a series of large mimeographed sheets which are issued for each month under the auspices of Estrellas Observatory, which was described in the August-September (1933) issue of POPULAR ASTRONOMY. Timely and current astronomical topics are presented in an interesting manner. Its avowed purpose is to form a bond for those in the southwest who make astronomy a hobby. It may, however, be obtained by any one for the price of one dollar a year. The Bulletin issued for August (1933) is number 24. The amateur in astronomy will find much of interest and value in concise and compact form in this publication.

Planetary Coördinates for the Years 1800-1940, prepared at H. M. Nautical Almanac Office, Greenwich, England. Price $12^s\ 6^d$.

This volume of 156 pages, octavo size, consists of a tabulation of the coördinates of several planets at definite intervals, usually between the years 1920 and 1940 but extending farther into the past in some instances, notably in the case of Jupiter and Saturn in which they extend, at longer intervals, as far back as 1800. Accompanying these lists of coördinates are fifteen tables of various kinds designed for use by computers engaged in research upon the perturbation of comets and minor planets by the larger members of the solar system. This material is all based upon the equinox of 1950.0; coördinates are given in degrees and fractions

of degrees, instead of in minutes and seconds; and, finally, it is assumed that the worker will be equipped with one of the several modern computing machines.

The scope of the material in this volume is very extensive. The volume will be found exceedingly valuable in the special branch of astronomical research to which it pertains.

An Astronomer's Life, by Edwin Brant Frost. (Houghton Mifflin Company, The Riverside Press, Cambridge, Mass. Price $3.50.)

An unusual touch of human interest comes to the reader of biography in Professor Frost's account of his own career, under the title of "An Astronomer's Life." A descendant of New England ancestors, Edwin Brant Frost spent his early life in the hills of New Hampshire where his father was a professor in the Dartmouth Medical School.

The early chapters of the book recount in great detail reminiscences of boyhood days, of much interest to those who know Professor Frost personally and the local background so familiar to sons of Dartmouth, but probably of less interest to the general reader than the later chapters that recount the progress of astronomy while depicting the events in the life of an observatory director.

From boyhood days Edwin Frost naturally grew into the Dartmouth environment, and shortly after his graduation there began teaching within its halls. After a period of study in Europe, particularly at Potsdam then the outstanding center for pursuing work in astrophysical lines, Dr. Frost returned to Hanover as Professor of Astronomy, remaining there until the opening of the Yerkes Observatory of the new University of Chicago which called him westward in 1898.

The unusual opportunities offered by the outstanding equipment of the new observatory under the direction of Dr. George Ellery Hale afforded opportunities for Professor Frost's enthusiasm in astrophysical research. The development of the Yerkes Observatory program soon resulted in an expedition to the Pacific coast by Dr. Hale for the establishment of a solar observing station under the peculiarly advantageous skies of California. As a result of Dr. Hale's expedition the Carnegie Institution of Washington established the Mount Wilson Observatory, calling Dr. Hale to its head in 1905.

With the resignation of Dr. Hale as director of the Yerkes Observatory, Professor Frost was appointed to this position, a position which he held until his retirement from active duties in July, 1932, when Dr. Otto Struve succeeded him.

The account of Professor Frost's life during these active years is a chapter in the making of astronomy, and a glimpse into the intimacies of observatory life and the habits and characteristics of a notable staff of workers. Scientific meetings, conferences both here and abroad, with the experience of travel interspersed, add variety to the years of activity and life in the quiet town of Williams Bay, Wisconsin. There, seventy miles from Chicago, the location offered favorable opportunities for work with the 40-inch telescope, an instrument which is still the world's largest telescope of the refracting type. In addition to Professor Frost's duties as director of the observatory, he became editor of the *Astrophysical Journal,* the leading periodical of astrophysics and spectroscopy in America.

The book contains much of the dramatic element; comedy, narrative and tragedy are interwoven. While observing at the telescope in December, 1915, the astronomer passed through the tragic experience of losing the power of vision in his right eye through a sudden detachment of the retina. With the passing of time impairment of vision came likewise in the other eye. In 1921 Professor Frost

found himself almost totally blind not only to the universe of stars to which he had given life long study but to the world of literature in the progress of science upon which depends so much the activities of the mind. The character of the man is revealed in the adjustment to such hardship. As a cordial friend of Dr. Frost's once remarked, "Professor Frost has determined that if he must be a blind astronomer, he will endeavor to be the best a blind astronomer can be." Such a serious handicap would have closed the active career of many men, but Professor Frost with an indomitable will, and with the aid of able assistants and devoted friends, carried on the responsibilities of the observatory for more than a decade under such trying circumstances.

The book relates events to the end of 1932, fittingly including the eclipse of the sun of August 31, attendance at the International Astronomical Union meeting in Cambridge the following September, and an account of Dr. Frost's active participation in the planning of the opening of the Century of Progress Exposition.

It was indeed most fitting that, as a result of Professor Frost's suggestion to have the flood lights of the Exposition grounds turned on by the light of Arcturus shining through the great Yerkes 40-inch telescope, he should be one to make the introductory remarks on that occasion, an occasion when the radiant energy which left Arcturus at the close of the World's Fair in 1893 and traveling these forty years at a velocity of 186,000 miles a second arrived just in time to link the old exposition with the new in the release of electrical energy that was to illumine the Century of Progress Exposition.

In addition to the multitude of friends of Professor Frost, all those interested in astronomy, and many general readers, will find much pleasure in reading "An Astronomer's Life."

HARLAN T. STETSON.

Perkins Observatory, Delaware, Ohio, October, 1933.

Publications Received.—The publishers of POPULAR ASTRONOMY hereby acknowledge the receipt of the following named publications and express their great appreciation of the courtesy shown on the part of those who have sent them.

Annals of the Observatory of Lund, No. 3. This is a large sized volume of 147 pages, and furnishes tables for the conversion of equatorial coördinates into galactic coördinates, which will serve a valuable purpose in the increasing number of investigations relating to the structure of the sidereal system.

Contribution, No. 66, from the Lund Observatory, entitled, Positions of 241 stars, mainly long-period and irregular variables and proper motions for 117 of these stars, by Frida Palnier.

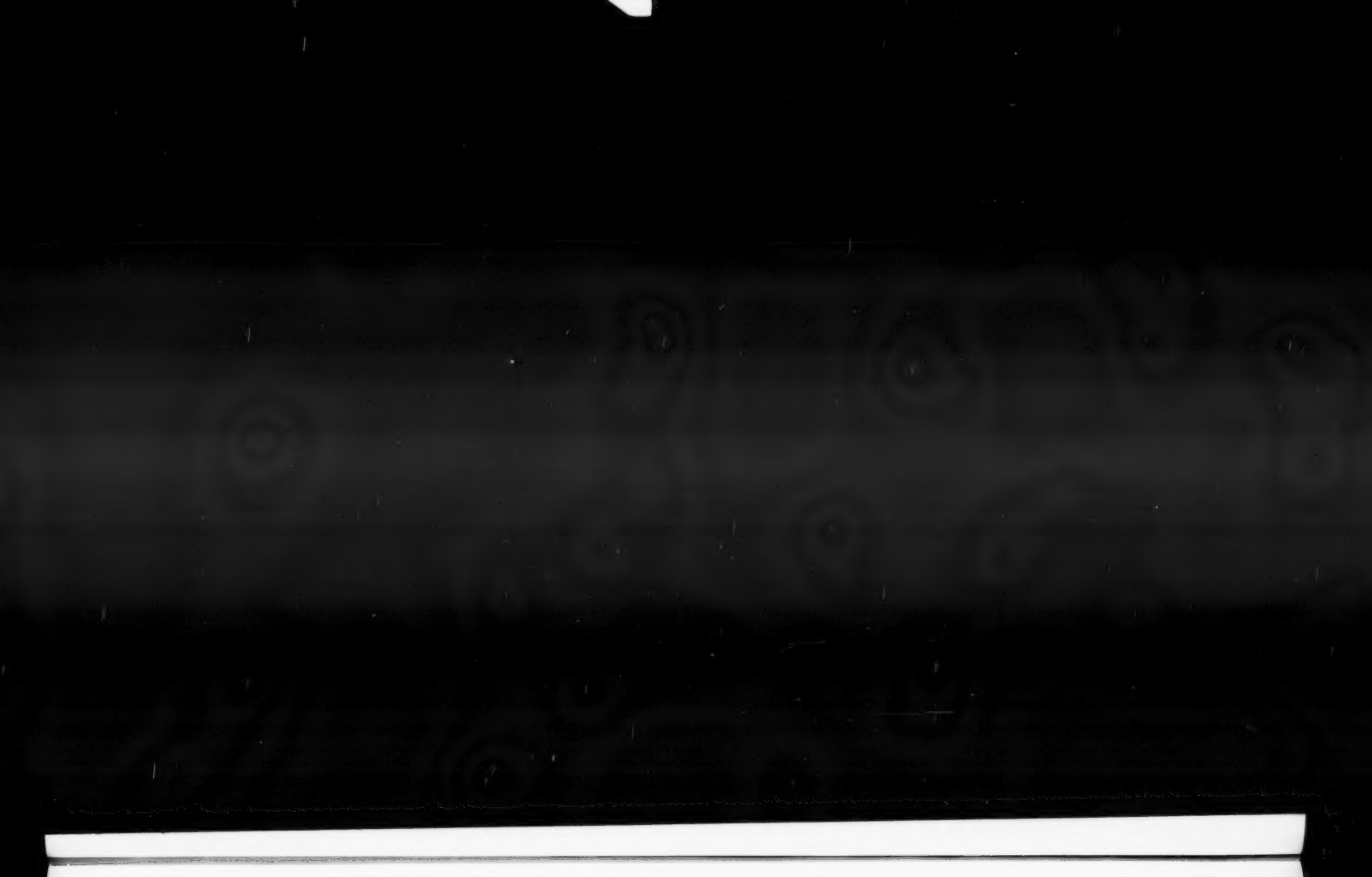
A number of the Contributions from the Mount Wilson Observatory have recently been received. These are reprints from the *Astrophysical Journal* in 1932.

No. 444. Spectrum of the Iron Star XX Ophiuchi, by Paul W. Merrill.

No. 447. Mean Ionization in Stellar Atmospheres, by Henry Norris Russell.

No. 448. Lines of Tungsten and Rhenium Appearing in the Spectrum of the Electric Furnace, by Arthur S. King.

No. 449. Spectral Energy-Distribution of the High-Current Vacuum Tube, by J. A. Anderson.

No. 450. The Spectrum of B.D. +11°4673 During the Years 1929-1931, by Paul W. Merrill.

No. 451. Characteristic Features of Solar Prominences, by Edison Pettit.